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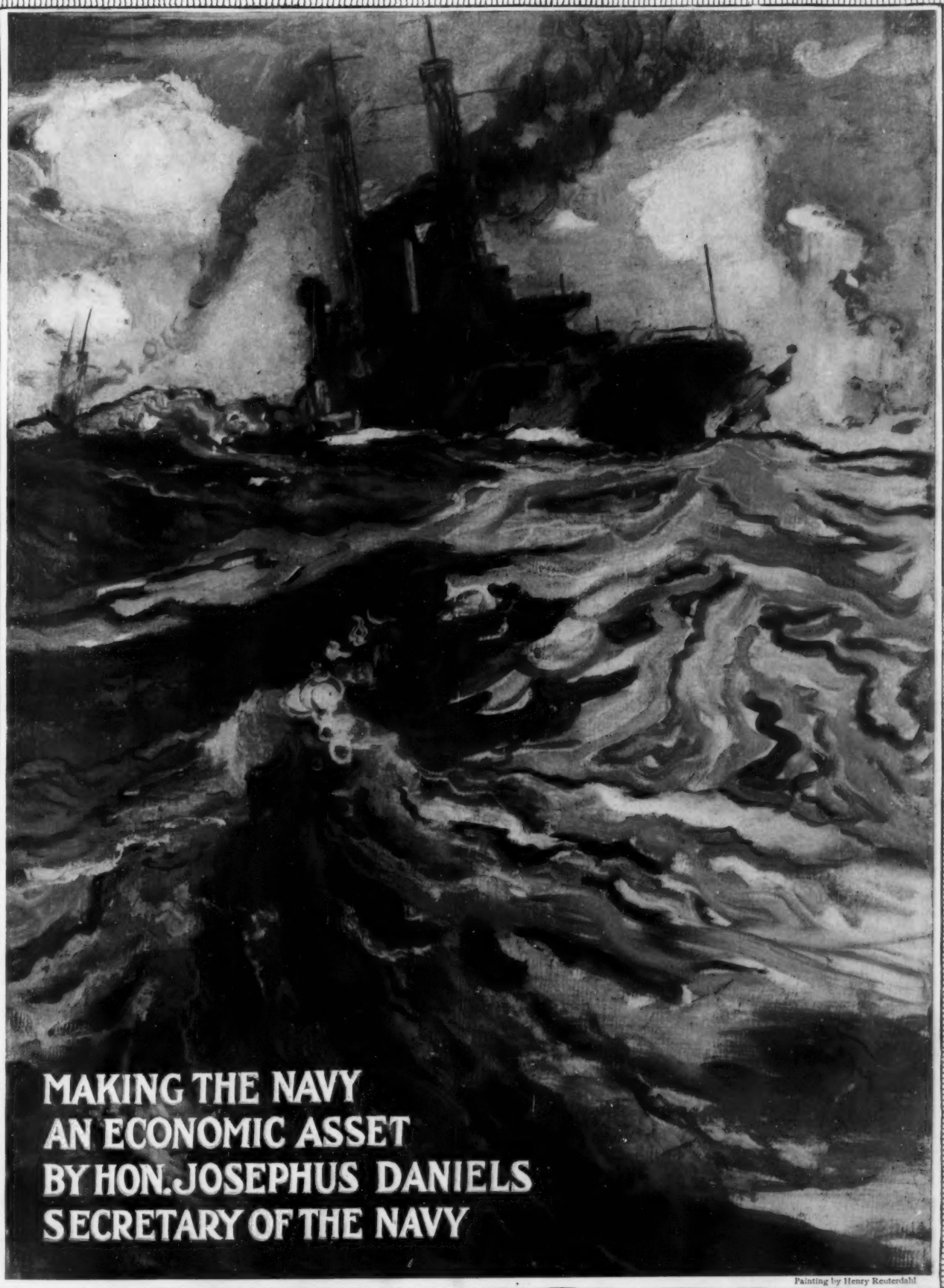


MAKING THE NAVY AN ECONOMIC ASSET

BY HON. JOSEPHUS DANIELS
SECRETARY OF THE NAVY

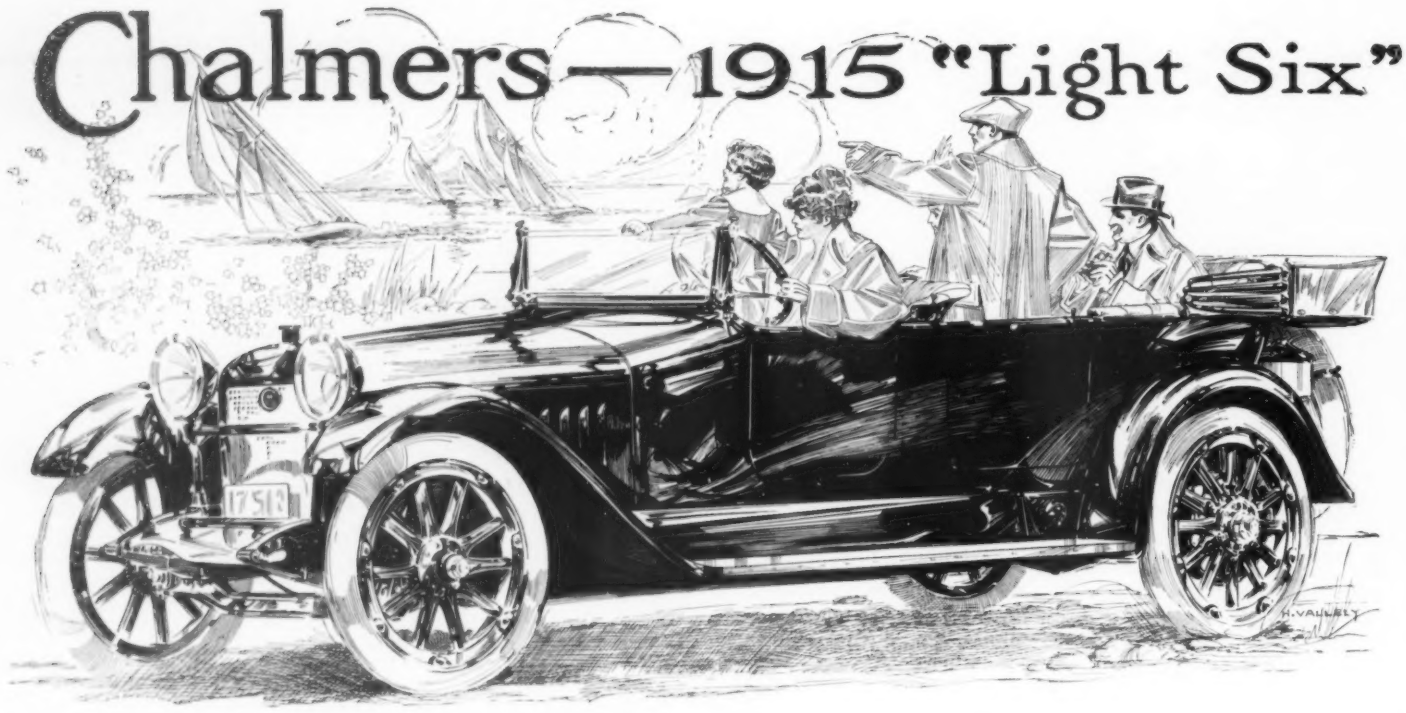
Painting by Henry Reuterdahl

Vol. CX. No. 18
May 2, 1914

Munn & Co., Inc., Publishers
New York, N. Y.

Price 15 Cents
$3.00 A Year

Chalmers—1915 "Light Six"



A New "Light Six" of Chalmers Quality—$1800

In addition to the famous Master "Six" at $2175 we now offer you the Master "Light Six"—a new Chalmers model at $1800.

Here is a 1915 car at $1800 with all the features that have given "Sixes" first place in the high priced field: Silence, smoothness, flexibility, beauty. It has, besides, what "Sixes" in the past have lacked: A low first cost, which makes it easy to buy; low operative cost, which makes it easy to keep.

The Master "Light Six" is a full year ahead; in style, in mechanical design, in simplicity, in efficiency. That's why thousands who once thought a "Six" an extravagance are now ordering 1915 Master "Light Sixes" faster than we can build them.

A "Six" or Nothing

This is the car for which thousands who would have a "Six" or nothing have waited.

The 1915 Master "Light Six" offers for the first time the full measure of 6-cylinder silence, smoothness and flexibility at the price of any comparable "four."

The Master "Light Six" at $1800 makes it unnecessary now to pay a high price, or a high maintenance cost to get six-cylinder luxury.

This 1915 Chalmers answers the last arguments of the four-cylinder builders —those of price and economy.

A Lighter Master "Six"

What the Chalmers Master "Six" at $2175 is among high powered cars, the 1915 "Light Six" at $1800 is among cars of its class. It has the same Master Motor, though built on a lighter scale. It has small bore and long stroke to give it flexibility; perfect balance to give it smoothness; right design to give it silence.

Its Chalmers-Entz electric starter makes the motor non-stallable. Tapered bonnet, oval fenders and streamline body rank it with the expensive foreign cars in looks.

Its lighter weight means an added economy. Yet it is heavy enough to make it safe in any emergency, comfortable on any road. Don't make the mistake of buying too light a car. The difference in gasoline consumption between a medium weight car and a flimsy car won't amount to $25 in 10,000 miles, and $25 won't buy many repairs for a car so light that it shakes to pieces in ordinary service.

Like all Chalmers cars, the 1915 "Light Six" is built to give satisfactory service through many seasons.

Buy This Car for Economy's Sake

Men want silence for its charm; smoothness, for its comfort, and flexibility for its convenience. And they want these six-cylinder qualities, too, because they make motoring nerve soothing, not irritating. You can drive a Chalmers "Six" 200 miles and be less fatigued than after 100 miles in a "four." Forty miles an hour in a "Six" doesn't give the nerve rasp of 25 miles in a constantly vibrating "four."

Men want these qualities for economy also. They know that vibration means needless strain on gears and bearings as well as nerves; power wasted in joggling the car instead of driving it.

They know that absence of noise means absence of undue friction; that a flexible motor means an economical motor. They know that only a "Six" can have these qualities. So they buy the 1915 Master "Light Six," for its economy as well as for its charm.

A Car of Super-Value

It is hard to believe that any car at $1800 could possess all the advantages we claim for the Master "Light Six." Until you see it, you cannot realize its distinguished beauty; until you ride in it, you can know nothing of the extraordinary value it offers at the price.

When we say the 1915 "Light Six" is a year ahead of others, we mean just what we say.

Chalmers Motor Company, Detroit, Mich.

In design, in luxury, in endurance, in good looks we believe this to be the most advanced "Six" on the market. It has today the features of construction and equipment which most cars in the $2000 class will not have for another year.

So we urge you to take the Chalmers Test Ride with our nearest dealer. Let the car itself prove its super-value.

Try to Match It

After you have taken the Chalmers Test Ride, challenge any comparable car to duplicate the performance. Compare these features item for item with any car at near the price. We'll leave the result to you.

Six Cylinders
30 to 50 Horsepower
126-Inch Wheel Base
Electric Starter
Non-Stallable Motor
Electric Lights
Tungsten Steel Valves
Streamline Body
Molded Oval Fenders
Triple Heated Fuel
Timken Bearings
Interlocking Gears
Chalmers Sectional Piston Rings
Cork Insert Disc Clutch
Clean Running Boards
Left Drive
Center Control
Rayfield Carburetor
Tapered Bonnet
Underslung Springs
Full Equipment

The Larger Master "Six"

2, 4 or 5 passenger type, $2175
6 passenger Touring Car, $2275

For the man who wants a larger and a higher powered car, there's our Master "Six", the fastest selling "Six" at its price in the country.

This Master Car set a new standard among the larger "Sixes" for silence, smoothness and flexibility; its modest price and low upkeep set a new mark for economy among cars of maximum luxury.

No matter how high your ideals of superlative merit in a motor car the larger Chalmers "Six" will satisfy your most exacting requirements.

Former owners of $4000 to $5000 cars are fast finding out that in the Master "Six" they secure the same six-cylinder value without the usual expense of a car of high power and large size. They say that a really better car no one can buy; a costlier car no one really needs.

Please send me literature on the 1915 "Light Six" and the larger Master "Six"

Name .....

Street .....Town .....

State .....

Sci Am

LOOK AHEAD OR LAG BEHIND

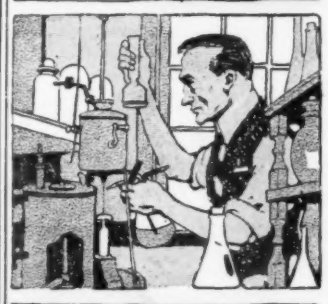
FORGET the map and watch the clock.

Time and not distance is the important factor in modern calculation.

Speed up. Your competitor has availed himself of the new opportunities which you disregard.

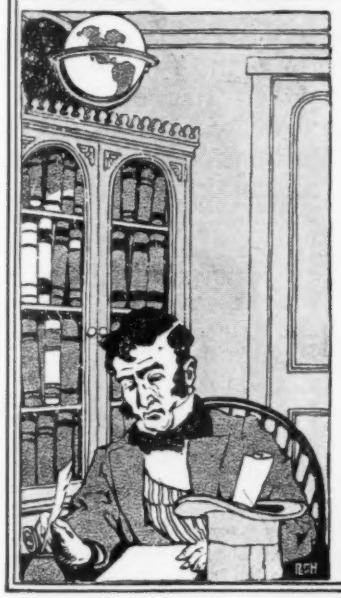
He has turned his back upon the obsolete notions of an incompetent era and has adjusted his affairs to fit the standards of the hour.

Yesterday's information can't serve today's necessities.



The wizards are busy, reviving, revamping, improving and supplanting.

Propinquity to a certain territory and accessibility to sources of supply constantly mean less to the man who relies too much upon his location for his prosperity.



You are always missing something—there is always a flaw in your selling plans. Keep the whole field under your eye.

You can't be contented and be safe.

The man who taught you your business couldn't survive a year under present conditions, and you won't last much longer if you rely upon his systems for your progress.

Use your head, or you won't keep ahead of the man behind.

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If this article is meant for you, so are Packard trucks. If it is not meant for you, you already use them.

2-TON	3-TON	4-TON	5-TON	6-TON	CHASSIS PRICES
$2800	$3400	$3550	$4150	$4300	F.O.B. DETROIT

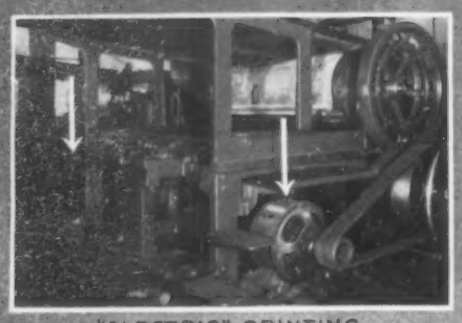
Packard trucks are predominant in one hundred and eighty-five lines of trade

Please address Department A in writing for truck catalog.

ASK THE MAN WHO OWNS ONE

PACKARD MOTOR CAR CO., DETROIT

LINCOLN HIGHWAY CONTRIBUTOR



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W

WESTINGHOUSE ELECTRIC

"ELECTRIC" SUGAR MAKING

Electrically Driven Machinery and Westinghouse Electric Experience

THE leading plants in over one hundred industries in this country are manufacturing all their goods with electrically driven machines.

They have experienced a reduction in manufacturing costs, obtaining at the same time a higher quality of product.

Even established factories that have found it necessary to scrap old fashioned machinery in order to install electric drive have saved such expense in a very short period.

The example of these leading factories is being followed by others. But in order to save a few dollars on the first cost the temptation is to apply motors of untried qualities, and to apply them without regard to the operating characteristics of the driven machine. The wise manufacturer will not make this mistake. He will invest in motors that have a name and that are exactly suited to his conditions.

Here are the questions which must be answered: "Who makes these motors? What *experience* has this maker had in applying motors to my business? What is the general reputation of this maker for giving service *with* his product?"

Westinghouse Electric *experience* in applying motors industrially places this Company in an unusual position in relation to every such prospective application. It covers every industry to which motors have been applied. The Company's written data on these industries is probably the most complete information ever collected on this special subject.

There is no experimentation at the customer's expense in the case of Westinghouse installations. There is always an intelligent understanding of the peculiar conditions and needs of the customer's business.

So far as design and years of service are concerned, the factory that buys a Westinghouse installation buys the *Westinghouse name*—a name which has been associated with important electrical developments ever since the Westinghouse Electric development of the alternating current.

It buys an organization which covers the country with offices and service stations. In short, it adds to your factory a complete engineering organization, one with a world-wide reputation.

The cost of such service as the Westinghouse organization offers is no more than the cost of the very best machinery possible to build would naturally be. It is certain that the negligible upkeep expense makes a Westinghouse installation the very cheapest in the end.

Any manufacturer interested will do well to dictate a line to us. Or any employee with the interest of his firm in mind may have certain special literature bearing on electrical drive for his particular industry. Address Dept. MJ.

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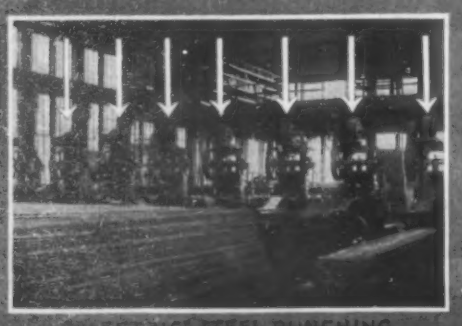
East Pittsburgh, Penna.

Sales Offices in 45 American Cities **Representatives all over the World**



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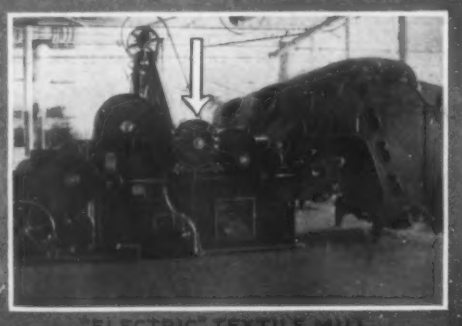

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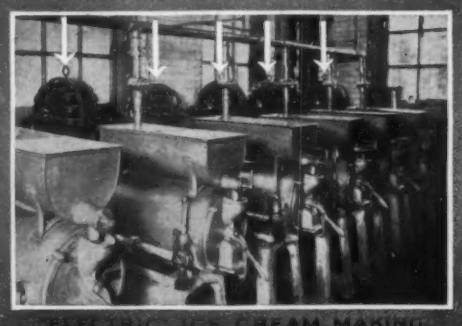

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SEVENTIETH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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The Problem of the Hudson River

How the Model Experimental Basin and the Moving Picture Machine Solved It

By Robert G. Skerrett

THE United States model experimental basin at Washington has recently performed a new service; it has helped the Government authorities to solve some of the vexed questions relating to the matter of pier extensions into the Hudson River. This it has done by reproducing in miniature the physical peculiarities of the dock encroachments and the tidal prisms of the North River, more especially at that section between Castle Point on the New Jersey shore and the Chelsea section of the New York city piers.

The army engineers and the experts of the Dock Department of the metropolis could not agree on the probable effects of further extensions to the Chelsea piers. The army engineers believed that further encroachments upon the flow of the river would cause serious perturbations and probably increase the velocity of the tidal movements. The city authorities wanted to build longer piers within the narrowed section of the river in order to accommodate 1,000-foot liners. The river was already but 2,800 feet wide navigably.

It was, therefore, urged that tests be made at the tank in Washington, and Naval Constructor D. W. Taylor and Col. H. C. Newcomer set about devising facilities and planning suitable models for this exceptional undertaking.

The army engineers had more than an inkling of the need of just such an investigation, for the history of the river during a number of decades told a convincing story of what the building of piers, the reclaiming of considerable areas of land along the shores, and the increased traffic had wrought in the interval. From 1858 to 1912 the velocity of the ebb tide had increased 60 per cent at that section just north of the Chelsea region, while immediately south the corresponding normal outgoing tide had gained in rapidity a matter of 87 per cent! As the "bottle-neck" lying between the Chelsea piers on one side and Castle Point on the other had narrowed the while, this means an ebb velocity of quite 4.08 miles an hour.

These changes have imposed a heavy tax upon river traffic, and especially upon tugs with tows and, prospectively, upon self-propelled canal boats—the speed of the latter within the canals being limited to four knots an hour. Hence, these boats would have to add greatly to their engine power for the single purpose of navigating a very small section of the river when trying to work up stream against the ebb. This was not all. These changes in the speed of the tide had well-nigh put a stop to all heavy towing in that part of the river during the periods of greatest current velocities. In short, the bulk of the lightering and barge work had to halt until the sweep of the tide slackened. A heavy handicap upon harbor traffic was imposed.

Because of the dangerous and disastrous forces exerted by suction between ships within "constricted waterways," Col. William T. Rossell, as senior member of the Harbor Line Board, urged that experiments be made in the naval tank at Washington not only to discover the possible effects of further narrowing of the river by pier extensions, but to study the perturbations set up in the water by the movements of incoming and outward bound liners when passing other craft or when flanking the open ends of docking spaces where other vessels were lying. Col. Rossell believed that these great express steamers seriously disturbed the river's normal sweep for considerable distances on either beam, and that these forces might constitute a serious menace to river traffic and to the vessels tied to the piers.

The basin at Washington was provided with a false bottom resting upon heavy steel I-beams, and the simulation of the width and depth of the river was upon a scale of 15/1,000. This false bottom was painted a solid color and then marked conspicuously by cross-lines which cut the reflecting surface into numerous squares. Attached to the underside of the towing carriage was a large mirror, at an angle of 45 degrees to the water, which reflected the false bottom, and made it possible for a moving picture camera located 75 feet in advance to take photograph of the changing view. Anchored over this false bottom were small aluminium buoys, to which were attached vertical rods, the positions of the tips of these rods at or below the surface being nicely controlled. The tips of these rods represented, for the time being, imaginary particles of water, and the aim was to trace the beginning, the directions, and the amplitude of their movements when disturbed by the subsurface perturbations set up by the approaching, passing, and retreating model as it was towed by the carriage. At the same time, a large dial on the carriage indicated the position of the model on its course, the face of the dial being divided into elements of the length of the miniature channelway.

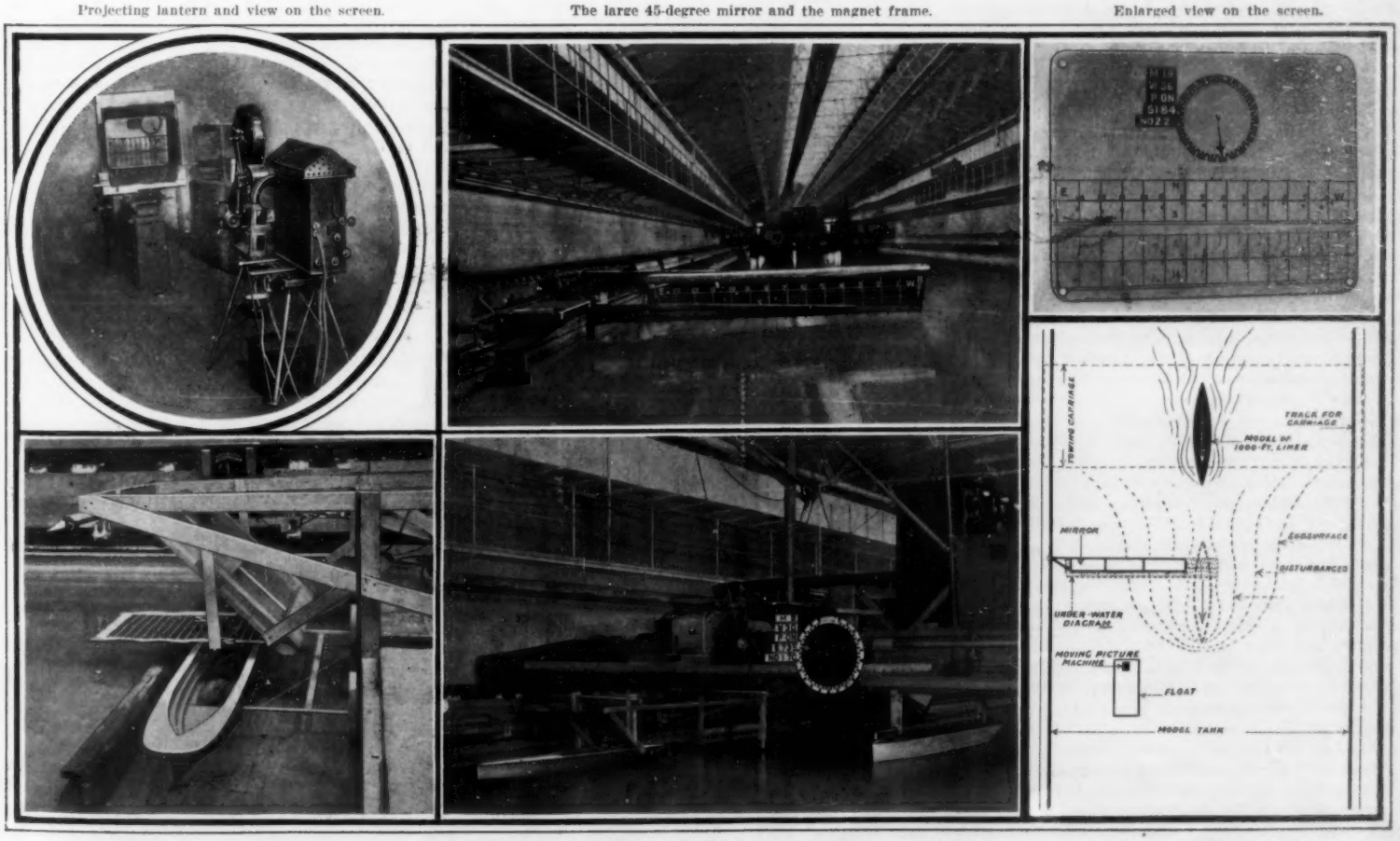
Two models were provided for the experiments, one 15 feet long, representing a 1,000-foot liner, and the other 10 feet long, standing for a ship of the same shape, but only 666.6 feet over all. The larger model was equipped with twin screws driven by an electric motor within the craft, and when running in this fashion the mission of the carriage was merely to guide its course. The object of this novel departure in tank experiments was to determine whether or not the action of the screws added materially to the force and zone of the water disturbances. The smaller model was placed alongside the piers to test the effects of the passing of the miniature 1,000-foot liner, and above the 10-foot model was suspended a screen by means of the cross-lines of which the camera could record the resulting movements. The 15-foot model was towed or run at four different speeds to represent a 1,000-foot liner moving at the rates of 6, 10, 15, and 20 knots an hour. The equivalent actual speeds on the part of the model were respectively, 0.735, 1.23, 1.84, and 2.45 knots. It was found that there was remarkably little difference in disturbance when the model was towed or when

(Concluded on page 378.)

Projecting lantern and view on the screen.

The large 45-degree mirror and the magnet frame.

Enlarged view on the screen.



A ten-foot model in its slip, showing the steadying and releasing gear.

Ten-foot model, mirror, and scale. This model stood for a ship 666.6 feet long. It showed how large liners affect smaller vessels.

Diagram of the experimental arrangement.

Ascertaining the effect of large liners on the shipping in the Hudson River.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Once More the Anti-vivisectionists

A VERY ingenious German once wrote a bitter book called "A History of Human Stupidity." In it he chronicles many delectable examples of medieval superstition, which retarded the progress of the world by centuries, as well as numerous examples of modern asininity. He holds up to ridicule not only the foolish way in which science was retarded by religious persecution in the middle ages, but also such supremely foolish acts as that of a European peasant who buried himself alive in order to escape the census-taker.

Some day that "History of Stupidity" will be amplified. Its most distressing new chapter will be devoted to the anti-vivisection mania which threatens to strangle scientific research, of whose inestimable benefit to humanity there cannot be the slightest question. In this campaign which ignorance, fanaticism and sentimentality have waged against humanity, surely the pinnacle of absurdity was reached when the bill to permit the Rockefeller Institute to establish a research laboratory in the State of New Jersey for the study of animal diseases and their cure was vetoed by Governor Fielder. One million dollars have been contributed by Mr. Rockefeller for research work on animal disease—research which is surely of vast importance when it is considered that our annual loss through the sickness of domestic animals amounts to one hundred million dollars for cattle alone and about seventy-five million dollars each for hogs and sheep.

Any one who has followed the proceedings of the recent medical congress in New York, an occasion upon which the most distinguished surgeons and physicians published to the world the progress which has been made in recent times in alleviating human suffering, must have been impressed with the high ideals of those who experiment upon animals in order to discover new methods of curing disease. If we are to credit the anti-vivisection ravings it might be supposed that the members of the Rockefeller Institute and similar institutions have no other object in mind than to obtain some devilish enjoyment by torturing guinea pigs, rats, and dogs. Of the great personal risks that these men run in handling deadly bacteria, of the weeks and weeks of patient experimenting, of the tragedies and martyrdoms of medical science, one hears nothing.

A score of medical men who could ill be spared have perished as a result of their special work in the field of X-rays. In his sixty-fifth year Dr. Robert Koch, the father of preventive medicine, remained for eighteen months on one of the Sese Islands in Victoria Nyanza, fighting incessantly with mosquitoes and ants and enduring "impossible food." With only one white companion, an army surgeon, he braved fevers and epidemics until at last he discovered crocodile's blood to be the chief nourishment of the tsetse fly, the voracious insect which transfers the trypanosomes, the specific cause of the sleeping sickness. Anti-vivisectionists would do well to read that wonderful letter which Koch wrote to his friend, Dr. Libbert, in which he says: "The flies engage our attention less than their victims. What a wonderful privilege it is to be able to save human beings who are doomed to certain death! It is this that makes it a real joy to be a physician."

What have anti-vivisectionists to say of the labors of Shiga, Ross, and Manson, men who have worked in daily contact with the deadliest toxins, all for the purpose of making the tropics and above all infection-ridden India tenantable by white men. And what shall be said of that committee of medical men which in 1900, in order to investigate the theory of Dr. Finlay that it was a mosquito which conveyed to human beings the germ of yellow fever, cheerfully volunteered to run the risk of subjecting themselves to the bite of the yellow fever mosquito? Surely war can display no finer heroism than this, and surely men who can make such great sacrifices can not be guilty of wanton cruelty to the lower animals.

Economy of the Modern Steam Engine

THE economies which have been secured in steam engine practice by the introduction of the steam turbine are strikingly illustrated in the installation which is being emplaced at the power station of the Interborough Rapid Transit Company, East River and Seventy-fourth Street, New York city, where the three largest turbines in the world are being built by the Westinghouse Company for the operation of the new subway. The turbines will supply sufficient electric current to operate 135 fully loaded ten-car trains accommodating 135,000 people. They are of the cross compound type, and consist of two sections, a high pressure and a low pressure unit. The high pressure unit will receive steam at 200 pounds pressure, and will drive a direct-connected generator running at 1,600 revolutions. The exhaust from the first unit will be utilized by a larger, low pressure unit, running at 750 revolutions per minute. From this the steam will pass to the condenser. Each turbine will be direct connected to a dynamo which will deliver 30,000 kilowatts, or about 41,000 horse-power; and, at full overload, each machine can deliver 36,000 kilowatts, or practically 50,000 horse-power, for a short period of time.

The economies of the turbines, as compared with the existing reciprocating engines, are many and very large. The turbines occupy less space, weigh less, effect a large saving in lubricating oil, and call for a smaller operating staff. Thus the new turbines will require about 1,645 square feet of floor space, representing an area measuring 31½ feet by 52 feet, and this is about the same as that occupied by the original reciprocating engines installed in 1901, which were illustrated at the time in the SCIENTIFIC AMERICAN. But although the space occupied is the same, the total output of power will be four times as great as that from the old plant.

The amount of steam used, and the enormous amount of cooling water required for the condensers, afford figures that are positively astonishing to the layman. Each unit will use about 350,000 pounds of steam per hour, and to condense this steam so that all the benefits of a vacuum may be obtained in connection with the low pressure unit, each turbine must be provided with a condenser containing 50,000 square feet of cooling surface. To insure this the condenser will contain 36 miles of brass tubing one inch in diameter. The necessary amount of cold water for circulation through the tubes will be drawn from the East River, and through each condenser there will be passed every hour 4,500,000 gallons of water. To pump this amount of water through the condensers for the eight units which will be ultimately installed calls for a tunnel 12 feet 4 inches wide and 12 feet 4 inches in height.

The saving in the coal bill by the use of turbines is truly remarkable. In the old cross compound reciprocating engine only 17½ per cent of the heat evolved by the combustion of the coal was turned to practical use, or as the engineers say, the thermal efficiency was only 17½ per cent. Moreover, 17 pounds of steam had to be consumed to deliver one kilowatt of power for one hour. With the new cross compound turbines a kilowatt of power will be secured on a consumption of 11¼ pounds of steam per hour. Under the present operating conditions 300,000,000 gallons of water are turned into steam every year for the use of the reciprocating engines. The new turbines will do the same work on 200,000,000 gallons of water with a corresponding reduction in the amount of coal that must be burned on the grates of the boilers.

The Mexican Navy

MEXICO is not entirely devoid of a navy. In fact, she possesses seven fighting ships, possibly four or five transports, and, for harbor service, she has three old schooners built by that Laird firm which was responsible for the armed cruisers which gave the North so much trouble during our civil war. The largest vessels of her little fleet are two cruiser transports, the "General Guerrero" and the "Progresso." These are modern ships, the first built by Vickers, Maxim, in 1908, and the second by Odero, in 1907. The "General Guerrero" is a vessel of 1,880 tons, armed with six 4-inch guns and two 3-pounders. Her engines of 1,200 horse-power give the ship a speed of 12 knots. The "Progresso," of 1,690 tons, is a single-screw ship of 14 knots, armed with four 4-inch rapid-fire guns.

Next in size to these are four gunboats. The "Bravo" and "Morales," built by Orlando, in 1903, are sister ships of 1,200 tons displacement, carrying a complement of 150 officers and men. They were designed to steam at 16 knots with 2,600 horse-power, and each is armed with two 4-inch rapid-fire guns, six 6-pounders, and with one 14-inch torpedo tube carried above the water line. These are twin-screw gunboats, and each carries about 200 tons of coal. The other two gunboats are the "Tampico" and the "Vera Cruz," built in 1902 at Elizabethport, New Jersey. Each is of 980 tons displacement, and the complement of officers and men is 98. They can steam 16 knots with 2,400 horse-power, and the armament consists of two 4-inch rapid-fire guns and six 6-pounders, with one 14-inch torpedo tube in the bow above the water.

The other vessels are obsolete, the most important being the "Zaragoza," built in 1891, and rebuilt in 1910. She is of 1,200 tons displacement and steams at a speed of 15.5 knots. Her armament consists of six 4.7-inch, rapid-fire, Schneider-Canet guns. The navy is also credited with a transport, the "Oaxaco," and possibly three or four others. The harbor service vessels are quite negligible, being nearly forty years old.

Mercury and X-Rays

RESEARCHES have recently been made by Landan and Piwnikiewicz on the phenomena of luminescence produced by X-rays acting on mercury vapor, particularly as regards the relation between the luminescence and the nature of the rays. The luminescence of mercury does not occur except at high temperatures. On making a vacuum in a glass vessel containing mercury and heating it and exposing it to the X-rays, an intense bluish green fluorescence is observed. Appropriate diaphragms permit one to limit the sheaf of rays, and, in consequence, the luminescent surface. The authors observed that the fluorescence is accentuated as one increases the density of the vapor, while the addition of foreign gases diminishes the intensity of luminescence, of which the emission spectrum is continuous. The authors explain these phenomena as follows: The energy of the X-rays being absorbed by the vapor, the increase of intensity resulting from an increase in density is easily understood. The atoms of mercury emit secondary kathode rays, to which the strong ionization is due. Now, the presence of a lighter foreign gas causes these secondary kathode rays, by successive molecular shocks, to pass, for preference, across the lighter gas, which necessarily enfeebles their effect upon the molecules of mercury.

Kathode Rays and the Tail of Comets

FOR some time the luminosity of cometary appendages has been attributed to electrical phenomena analogous to those which take place when a tube of rarefied gas is traversed by an electric discharge. But this rather vague explanation took the second place when Arrhenius came forward with the theory that the tails of comets are due to the pressure of radiation from the sun. But another explanation has been offered recently which is, from some points of view, more satisfactory. The nucleus of a comet is regarded as a permanent source of electrons which are projected into the cometary atmosphere. If now the electric field of the sun is centripetal, the luminous effects, due to the projected electrons, should be localized in the direction opposed to the sun. From researches made on the magnetic field of the sun, and applying the theory of Schuster, which attributes the magnetism to electric charges carried round by the sun's rotation, it appears that the dominant electric charge on the sun should be negative, which results in a centripetal electric field; thus, the above hypothesis accords with the most recent discoveries.

The Degeneration of the Arab Horse

THE Arab horse, a race which has been all-important in the development of the most valuable equine breeds of the present day, is said to be deteriorating in quality and diminishing in numbers in its original home, owing to changing habits of the Bedouins and increasing exportation. The *Philippine Agricultural Review* states that as a step toward preserving this famous breed there is being formed in Cairo an International Horse Society. The first work of this society will be to start a studbook, one part of which will include only pure-bred horses of desert origin, while the other will be open to all so-called "eastern" horses; i. e., horses bred in the near East, but having an infusion of alien blood. Pure-bred Arabians are now found only among the different Bedouin tribes of the Arabian and Syrian deserts (in Mesopotamia and the Nejd); in a few private studs in Egypt; and in a very few European and American studs. The society will hold annual shows and auction sales at which will be offered animals of certified purity of pedigree.

Kerosene Motor Competition Postponed.—The kerosene motor competition, which was to have been started by the Automobile Club of France, Paris, on October 1st next, has been postponed. It will take place commencing November 15th.

Engineering

Four One-Thousand-Foot Drydocks Built and Building.—There are now four drydocks of 1,000 feet in length built or under construction. The Gladstone Dock, 1,000 feet long, has been completed at Liverpool. Another is being built at Quebec, and a third at Boston. Last month the Hughes drydock at Bombay, India, 1,000 feet long, 100 feet wide, with a depth of 30¼ feet, was opened.

Lives Saved by Street-Car Wheel-Guards.—The Public Service Commission states that recently, in three days, eleven persons were run down by street cars, and that ten of them were saved by the operation of the wheel-guards. These guards were installed by order of the Commission, and their saving of human life has been proved time and again. In one case two boys were picked up together; at another time an elderly man was saved from passing under a car, with no greater hurt than a few bruises.

Subway Carries Two Billions Without a Fatality.—The Interborough Rapid Transit Company, which operates the New York Subway, points with justifiable pride at the fact that the present subway has transported 2,198,000,000 persons in the last nine years without a single passenger fatality, and this in spite of the fact that the speed and frequency of this train service is unsurpassed in work of this character. The subway is undoubtedly the most efficiently operated railway system in the world, and there is no doubt that this wonderful record for safe travel is, on the mechanical side, mainly attributable to the efficiency of the automatic stop.

Demolition of the First Sky Scraper.—There has recently been demolished, to make way for a larger structure, a ten-story tower building, at 60 Broadway, New York city. The building was erected in 1889 and has been in service for a quarter of a century. Naturally the condition of its framework was a matter of interest for architects and engineers. The frame consisted of cast iron columns and wrought iron floor beams. The floors were of flat-arch, terra cotta construction. The framework was found to be in excellent condition, the wrought iron beams showing a practical absence of rust, and the cast iron columns, with a three-inch cast iron shell around them for fire protection, showing only a few localized patches of rust and heavy rusting only at a few special points.

Reconstruction of the Lachine Bridge over the St. Lawrence.—The once notable Lachine Bridge of the Canadian Pacific Railway over the St. Lawrence River near the Lachine Rapids, about seven miles above Montreal, has recently been renewed and double-tracked. The old single-track bridge, built in 1885-1887, consisted of two channel spans, each 480 feet long, and deck spans 80 to 270 feet long. An interesting feature of the channel spans was that they were connected to the adjacent 270-foot spans by curved connecting chord-pieces, thus making the four spans continuous. The old bridge was designed for a loading which was only about one half of the train load for which the new bridge has been designed—an eloquent commentary on the rapidity with which the weight, power and capacity of our freight train service has increased in the last quarter of a century.

The Beaufort Scale of Wind Velocity.—The Weather Bureau, which is under the United States Department of Agriculture, has announced that on and after April 1st it will utilize the Beaufort wind scale to designate the velocity in all wind forecasts and storm warnings. The Beaufort scale as thus announced is as follows:

Force.	Destination.	Miles per Hour.
0	Calm	From 0 to 3
1	Light air	Over 3 to 8
2	Light breeze	Over 8 to 13
3	Gentle breeze	Over 13 to 18
4	Moderate breeze	Over 18 to 23
5	Fresh breeze	Over 23 to 28
6	Strong breeze	Over 28 to 34
7	Moderate gale	Over 34 to 40
8	Fresh gale	Over 40 to 48
9	Strong gale	Over 48 to 56
10	Whole gale	Over 56 to 65
11	Storm	Over 65 to 75
12	Hurricane	Over 75

A Movement for Good Roads.—The American Highway Association and the American Bar Association have inaugurated a movement to remove from the statute books of various States, ancient and obsolete road laws which have been on those books more than one hundred years. The first step in the revision of the State road laws would be to recommend that all obsolete and unnecessary laws be rescinded. Certain basic features of good administration will be urged by the joint committees, such as payment of road taxes in cash, elimination of unnecessary officials, the requirement of skilled supervision in construction and maintenance, constant employment of highway engineers, the substitution of appointed for elected officials and the substitution of continuous maintenance for the present intermittent methods.

Science

A Statue of Dr. E. A. Wilson, who perished with Capt. Scott in the Antarctic, is to be unveiled some time next July at Cheltenham, England, Dr. Wilson's birthplace. The statue is the work of Lady Scott, and the unveiling ceremony will be performed by the veteran explorer Sir Clements Markham.

Phosphates in Egypt.—We learn from the *Bibliothéque Universelle*, that vast deposits of phosphate have recently been discovered in the valley of the Nile, on the coast of the Red Sea, and in the oasis of Dakhla. They are composed of fossils and contain impurities consisting chiefly of silica and various salts of iron. The largest beds are at Dakhla, and have a thickness of 2-3 meters, with a width ranging from 4-5 meters to a kilometer and a half.

The International Seismological Association will hold its third general meeting, coincidently with the fifth conference of its Permanent Commission, at St. Petersburg, early in September, under the presidency of Prince Galitzin. The preliminary programme, just distributed, shows that among the principal topics of discussion will be terrestrial tides, together with related questions, such as the elasticity of the earth's crust. A somewhat novel field of discussion will embrace the various possible relations of earthquakes to electrical and magnetic phenomena.

Explosive Dust in Mills.—The engineers of the U. S. Bureau of Mines have, during the past year, investigated every mine coal-dust explosion in which more than two lives were lost. As an auxiliary line of investigation the Bureau has undertaken a study of other inflammable dusts. One investigation related to a grainmill explosion at Buffalo in which 33 lives were lost, and a co-operative arrangement has now been made with the National Milling Association for carrying out further studies of inflammable dust in mills, the cost of the work to be borne by the association.

Lessening Fatigue.—It is well known that it becomes fatiguing to carry a heavy weight in the hand, such as a valise, for any considerable distance, especially because it hinders the movement of the lower limbs. A Frenchman has found a way to prevent this inconvenience, which is as simple as it is practical, and all that is needed is to put under the arm a bulky packet, which is made up of a dozen newspapers folded together. In this way the handbag is far enough removed from the legs so as not to hinder walking with ease. He says that the fatigue is much less and the weight appears to be lighter.

Hailstorm Insurance.—Statistics for the year 1911, recently published, show that the custom of insuring crops against hail is much more prevalent in Germany than in any other country. The total amount of hailstorm insurance carried in Germany in that year was $825,000,000, as compared with the following amounts in other countries: Austria-Hungary, $202,500,000; France, $193,750,000; Italy, $100,000,000; Roumania, $100,000,000; Argentina, $62,500,000; Denmark, $55,000,000; Sweden, $25,000,000; Russia, $20,000,000; Switzerland, $15,000,000; Netherlands, $7,500,000; Spain, $5,000,000; Belgium, $2,500,000; Bulgaria, $1,250,000. In Bavaria, Austria-Hungary, Bulgaria, and the Canadian province of Alberta this form of insurance is conducted by the government. The premiums for hailstorm insurance are supposed to be based upon the average frequency of hail, and upon the kind of crop insured; some regions being much more subject to hailstorms, and some crops much more susceptible to their effects, than others. In parts of Italy, premiums up to 5 or 6 per cent are paid, while in Argentina they reach 10 or 12 per cent.

The Sanitation Service of Porto Rico, which was organized in 1911, has recently been much improved through the establishment, by the Porto Rican Legislature, of an Institute of Tropical Medicine and Hygiene, the president of which, Dr. W. F. Lippitt, is also director of sanitation in the island. One of the first undertakings of the Institute was to organize a school for sanitary inspectors, in order to provide a properly trained personnel for the sanitary service. To this school were brought last year those young men employees of the service who, by zeal and attention to duty, had shown themselves worthy of promotion and permanent employment, and the classes were also thrown open to non-employees, with the understanding that those who passed the examination would be given preference in future appointments to the service. Graduates of the school are already doing efficient work in various parts of the island, where previously no persons having any knowledge of sanitation were available for appointment as inspectors. This year, the work of the school will be enlarged, to include courses for health officers. So far as known, this is the only school in the world established for the purpose of training an official sanitary corps. The Institute, of which this school is an appendage, will also engage in research work. One of its members, Dr. P. G. Igaravidez, was sent last year to attend the School of Tropical Medicine in London.

Aeronautics

A New Altitude Record for Balloons is announced in a book by Dr. A. de Quervain, describing his recent crossing of Greenland. Two members of his party, Drs. Jost and Stolberg, remained on the west coast, and during the winter of 1912-13 sent up pilot-balloons 120 times from the Danish scientific station at Godhaven, Disco Island. One of these was followed with theodolites from the ground to an altitude of about 39,000 meters (24.2 miles), which exceeds by about 4,000 meters the greatest height ever before attained by any form of aerological apparatus.

The German Air Traffic Bill.—The Reichstag recently took up a bill for regulating aircraft traffic. According to the *Engineer* the bill aims, in the first place, at minimizing accidents, and provides for this purpose that all new aeroplanes and airships are to be first tested on a flying ground. A second part of the measure deals with aerial navigation companies. As no such undertakings yet exist, great freedom is given to the Federal Council to issue regulations on this subject. Finally, the bill regulates by a number of complicated paragraphs, in which the provisions with regard to motor car traffic have for the most part been adopted, the liability for accidents caused by aircraft.

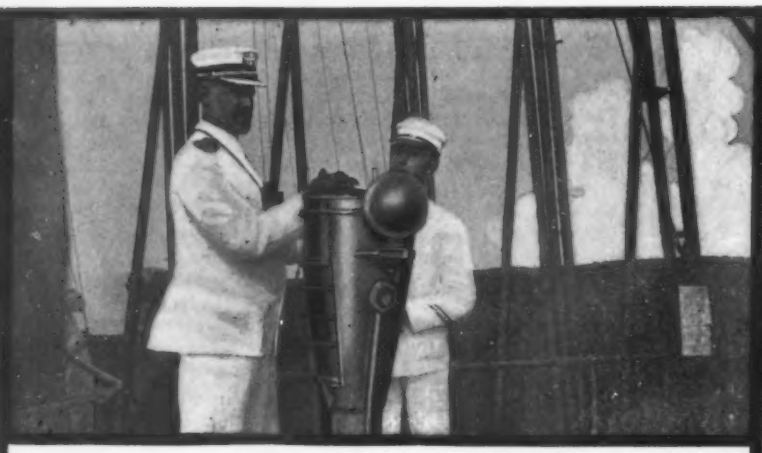
Russian Air Fleet.—The Russian government has drawn up a programme which provides that orders shall be placed for 330 aeroplanes, including 90 Sikorsky monoplanes and biplanes of the ordinary size and 10 giant Sikorsky machines of the type of the "Ilya Mouromets." For the small aeroplanes other than those of the Sikorsky pattern, recourse will be had to foreign types, such as the Farman, Deperdussin, Morane-Saulnier and Voisin. Two aeroplanes will be ordered from the German firm of Rumpler and two from the English firm of Sopwith, and two will be constructed on the system of the Russian Lieut. Kowanko. Besides these aeroplanes, two dirigible airships will be ordered in France and one in Russia. The programme will be completed by the autumn.

Atmospheric Pressure at Great Heights.—It is usually supposed that at great heights the pressure of the air is almost negligible, but the application of an ingenious method indicated by Ramsay gives interesting results. He asserts that the green line characteristic of the spectrum of krypton remains visible under a pressure of 0.000035 millimeters of mercury. Now this green line is found in the spectra of the aurora borealis and it seems to be well established that this exists frequently at altitudes between 100 and 200 miles, and even sometimes up to nearly 500 miles. But krypton is one of the heaviest gases in our atmosphere. It would seem, therefore, that the density of the air at these altitudes is by no means negligible, as whatever the cause may be of the presence of krypton there, it could not remain there unless the air possessed an appreciable density.

A New French Motor.—The new Paris-built aeroplane motor known as "E. J. C." differs from the usual types because it uses a double propeller, that is, two separate propellers rotating in opposite directions. The motor is of the kind in which the crank-case and six radial cylinders rotate in one direction, while the crank rotates in the other by mutual reaction alone. One double-blade propeller is keyed on the crank-shaft and another of the same kind, but with inverted thread, is mounted on the body of the motor, one screw being just back of the other, and the pair taking an X-shape when seen from the end. The screws are designed so that motor body and shaft take the proper speeds which are needed, there being 800 revolutions per minute for the motor and 1,200 revolutions per minute for the shaft, making a total of 2,000 revolutions per minute. But as the speed ratio varies with the running speeds, a differential is used inside the crank-case, so as to regulate the speed in the proper way. The present motor is of 60 horse-power size.

The Proposed Exploration of New Guinea by Airship, which has already been mentioned in these columns, does not seem likely to be realized in the near future. The original plan of Lieut. Graetz and his colleagues (some of the latter being scientific men of considerable eminence in Germany) was to raise the money needed for the expedition, about $750,000, in the three countries exercising sovereignty in New Guinea, viz., Germany, Holland and Great Britain. It has been found, however, that little interest was felt by the Dutch and British publics in this German project, while even in Germany the raising of funds has not made much progress. Moreover, the German Colonial Office has expressed disapproval of the undertaking, chiefly on the ground that the frequency of thunderstorms in New Guinea would make such an expedition extremely hazardous. Even if successful, it could add nothing to the world's knowledge of the biology, ethnology or geology of the island. The latest plan of the would-be aeronautical explorers is to exhibit their airship at the Panama-Pacific Exposition, and run a series of excursions with it for exposition visitors in order to raise money for their expedition.

A commander in working costume.



On the bridge of a modern dreadnought.

Enlisted man pointing a rapid-fire gun.

The Problem of Our Navy

X.—Making the Navy an Economic Asset

By Hon. Josephus Daniels, Secretary of the Navy

NO memory lives longer in the minds of a people than the remembrance of their past achievements in arms. It is well that this is so, for the inspiration of the past has enabled more than one tiny nation to defy its enemies and preserve its national existence against all comers. Yet we need to beware that this undying recollection of ancient deeds of valor does not make us reckless. It is also true that more than one nation, remembering its dead heroes, has beaten its swords into plowshares and forgotten the cunning of war for the cunning of trade, only to find that the deeds of gallant ancestors will not prove effective in defense if we are not prepared. It is well, I think, for our nation to bear in mind, when the spirit of '76 and the memories of the minutemen of Lexington arise strong within us, that we may be, perhaps, over-prone to feel that in our hour of need there will spring up heroic men who, like our ancestors, will conquer because they know not how to fail. Man against man we will have nothing to fear, but to-day it is not only man against man, but machine against machine as well. The man will always be equal to the occasion. For every crisis a man will arise. But while the man is greater than the ship, in our day the master man cannot win as aforetime unless we have the best ships and the best guns.

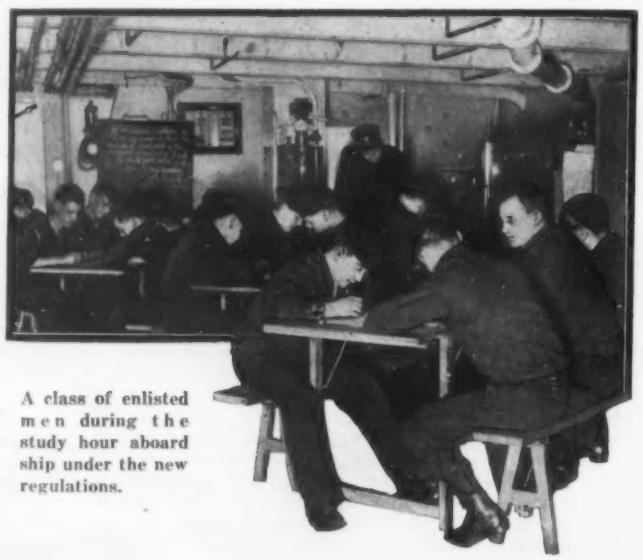
It is this feeling, in my judgment, more than any other, that leads so many of our people to shut their eyes to the cold facts and declare that a nation which in its infancy humbled the pride of England on the sea has no need of floating fortresses of steel to defend it in this, its high noon-tide of mature greatness. That such is the view of no small portion of our people cannot be denied. Congress is peculiarly sensitive to what the voters think, and no Congress would have cut our warship construction to one battleship a year in the face of the ambitious naval programmes of other powers had not a majority of the congressmen felt, at the time, that the voters "back home" rested secure in their dream that, in some way or other, dreadnought or no dreadnought, this nation would find some miraculous way of defending our shores against a powerful foe. That a clearer vision came later, and that the people have made it evident to Congress that a majority do not so hold, does not destroy the fact that this misplaced confidence exists in no small degree, particularly in those States far removed from our coasts.

Glories of the Past and Present Necessities.

I speak with greater assurance of this because the same feeling instinctively pervades my own sub-consciousness. Over the mantel by my desk hangs the sword of John Paul Jones; at the other end of the room, the silver urn presented to the great Hull. As I look first on one and then the other, all the cold facts, so ably presented to me by the naval experts—men of the highest scientific knowledge, who have spent their lives in studying this subject—lose, for the moment, their convincing power, and the feeling comes over me that with such men as naval captains a probable defeat upon the sea is foolish to consider. It is only when I turn to look directly across my desk at the model of the "Oklahoma"—so little like the white-sailed ships of the line, so scientifically grim and strong and impregnable, the physical embodiment of the cold science of to-day that aims entirely to eliminate the personal equation—that I again realize that more than a glorious spirit is needed to win a modern fight at sea, although now and always initiative, resourcefulness and courage are a trinity of determining factors in the crisis of battle.

The stricken captain of the next naval engagement will not die leaning against the mainmast, with the shadow of the enemy's sails falling across the deck, rallying his men to repel boarders. He will perish helplessly, in spite of courage unsurpassed, in a conning tower built like a burglar-proof safe, from a shell fired by an almost invisible enemy seven miles away, out of a gun that was pointed by strict mathematical rules after the working out of an elaborate algebraical equation.

I am mentally convinced, as any reasoning man who has studied the subject must be, that our Navy should be strengthened. I subscribe to much of the argument in the series of articles in this paper, to which I contribute this closing number; but if, in spite of the advantages given me by my position to learn the whole truth, it is hard for me to shake off this instinctive feeling that our nation needs no protection beyond its own brave citizens, how much more must those living far inland, whose only knowledge of dreadnoughts comes from the illustrated papers, hold to the view that Providence will protect our country without the need of dreadnoughts, and that an adequate navy is merely a needless national expense.



A class of enlisted men during the study hour aboard ship under the new regulations.

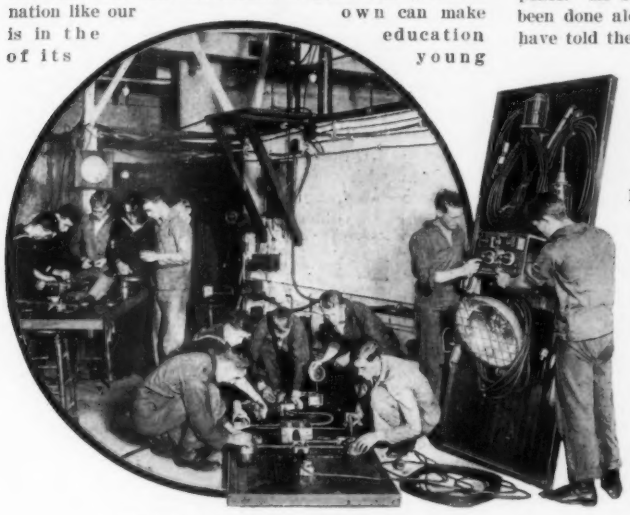
The Navy and the People of the Inland.

I sometimes fancy that our naval officers fail to understand the extent and depth of this feeling throughout the country. It is a point of view impossible to men like themselves who, from the day when they entered Annapolis, have had cold facts and figures hammered into them regarding the necessity of a defensive fleet to any country whose coasts are worth the harrowing and whose ports can be made to yield vast tribute to an attacking fleet. Because the popular point of view of this and kindred subjects is impossible for the trained naval man to understand fully, our wise forefathers decided that a civilian should be placed at the head of the Navy, a man who, understanding the feeling of the non-military people, can best adopt measures and frame arguments that will convince them of the imperative need of adequate powers of defense; for I hold that no one can convince until he understands what doubts are to be removed. In my own case, when I became convinced that loyalty, unswerving patriotism, and an exact scientific knowledge of the facts underlay the insistent demands of the Department's naval experts for an adequate Navy, the problem as laid before me took this form: Many people believe that an increase in the Navy is needless. This belief is instinctive and not founded on an investigation of the facts or knowledge of the subject. To convert a majority of these people, it would be useless to publish pages of statistics of numbers of ships, relative displacements, comparative muzzle energies, armor efficiency, steaming areas and kindred data, because the majority of them would not take time to read such tables, nor attempt to understand them if they did. Their gravest objection to an adequate navy is because of their belief that the Navy represents an expense to the Government without compensating benefit in return. The task that lies before the Secretary of the Navy, who understands this feeling on the one hand, but who has become convinced of its erroneousness on the other, is to find some way to secure at least the passive support of these people.

Can the Navy Be Made "Practical"?

Such being the problem, it would seem that if a way could be found to convince this portion of our people that the Navy is not merely an expense, but an economic asset to the country and a good business investment of the taxpayers' money, it would go a long way toward a solution of the situ-

ation, and would do much to win them from a position of active objection to one of absolute encouragement of a proper naval construction programme. The greatest economic loss to the country from the Navy, be it necessary or unnecessary, lies not in the money spent, but in the 50,000 men taken from gainful industrial pursuits; for the money spent on the Navy, it must not be forgotten, goes back again into the taxpayers' pockets, to a very large extent. The Navy is not like the rich American who goes abroad to spend his money, but the funds appropriated are used to pay American workmen and American merchants and American manufacturers, and is, in time, distributed among other American citizens, so that, in the end, practically all of it gets back into the taxpayers' pockets from which it came; but if the country loses the productive services annually of 50,000 men, it is a real economic loss without compensation. Now, it is practically universally admitted by students of economics and political economy that the best investment a great and powerful nation like our own can make is in the education of its young



Electrical school, Navy Yard, New York.

men, particularly along industrial lines, and that the nation which has the most efficient and well-trained citizens, skilled to use their heads as well as their hands, is most certain to win in the fierce competition for the world's industrial supremacy. On this point, the theorists and legislative bodies of the great nations of the world are agreed, if the legislation in all these countries in the last few years means anything.

Naval Appropriations for Education.

You do not hear of legislative bodies in our country, or in any other, squeezing to the last degree appropriations for education; and in Germany, which is one of the leaders in all scientific and industrial movements, provisions for the education of the workman along the lines of his profession are being constantly increased. In our own country, he would be a brave congressman who would dare to say that the hundreds of millions

Yeomen's school, Mare Island, California.

spent by the taxpayers on our public schools was a wasteful extravagance or a needless expenditure of money. If, therefore, it is necessary to make our Navy not only a proper protection to our country, but an economic asset as well, if we would gain universal support to its proper upbuilding, and if the real economic waste of our Navy at present is in the men withdrawn from industrial pursuits to man our ships, why cannot the result aimed at be achieved by taking these men during the time they are in the service of the Navy and training them to the highest degree, so that on their return to civil life they will become a hundredfold more efficient industrial units than they were before?

If we can do this, it seems to me we will make the Navy in times of peace a national asset that will be well worth the money. I feel that the Navy presents a great opportunity and should play a great part in the training of our young men. Consider the situation! Here are 50,000 young men, in part suffering from the handicap of limited educational opportunities, and in part, of the type which makes the poorest industrial unit, the type that chafes at the strict discipline of home and factory, and that likes to wander abroad and see new things. If the Navy can take these men, advance their school-book education while, at the same time, training them in discipline, until they realize that to command they must first learn to obey, and in addition, can train their hands to be skilful in the industrial arts, it will surely be something really worth while.

What the Secretary of the Navy is Trying to Do, and Why.

I am not, here, discussing the necessity for increasing the Navy in any case, but of trying to turn what some consider a necessary evil into an important factor in the development of the nation and, in so doing, securing the support of those who remember only John Paul Jones and forget what happened to an inferior fleet, though manned by brave men, at Santiago. I have tried to elaborate in detail the reason underlying my efforts to make the Navy a great school, as well as a greater enforcer of the peace. As for the details of what has been done along these lines, the newspapers have told them in full; the daily classes for the sailors, the technical training and opportunities to learn a useful trade now offered all enlisted men—all this has been printed many times.

My purpose here is to make my reasons plain. There have been many merry quips by newspaper paragraphers, and sometimes a serious misunderstanding of the aims of this new policy, and I would like the public to understand just what the present Secretary of the Navy is trying to do and why. To the question: Has this plan, so far as it has been in operation, given evidences of success? The best answer lies in the enlistment figures. I have had prepared a chart showing the enlistments this year as compared with the year previous, which is reproduced for the first time with this article. It will be noted that from the 4th of March, 1913, until April of that year, the rapid decline in enlistments of the year previous continued. In April it was definitely published that the fleet would visit foreign shores, and I then announced that it was my purpose to add what has been described as the "liberal education of travel" to my other educational plans for the seamen of our Navy. In the next two months the enlistments increased far beyond the highest point of the year previous.

After the fleet had sailed, the enlistments naturally dropped off, though to nowhere near the low point of the year before. In November, the details of my educational ideas were made public, and were commented upon generally by the papers. From 1565 enlistments in November, there was a jump to 2,000 enlistments in December, breaking all records in times of peace. Could better answer than this be made to the question?

"An Adequate Navy Large Enough and Powerful Enough to Make War with the United States too Unpleasant in Its Consequences to be Seriously Considered."

There are still many details to be worked out, but, so far, no serious objections have arisen to the accomplishment of my dream—an adequate navy, large enough and powerful enough to make a war with the United States too unpleasant in its consequences to be seriously considered by any foreign power, and, at the same time, a navy that will receive young boys with untrained habits and little technical skill and transform them into young men trained to discipline, physically fit, and possessed of a practical knowledge of technical mechanics, that will enable them to bear more than their share of the work of making our nation the greatest in the world. If this policy is successful, if this dream comes true, may we not claim that our Navy is no longer a necessary, though regrettable expense, but is, in reality, in a large sense an economic asset to our country?

An Automatic System of Calling Cabs, known as the "Autoruf" system, is described by the American consul general at Hamburg, where the system has recently been installed. Machines bearing an external resemblance to letter-boxes have been placed in all parts of the city, and are connected by wire with a central office. These machines serve as cab-stands, though it frequently happens that there is no cab at the stand. In the latter case a customer who wants a cab deposits

Yeomen's class at training school, Great Lakes. The yeomen's duties are largely clerical.

a coin (one mark) in the machine, and his call is automatically signaled to the central office, which sends him a cab from the nearest stand at which one is available; the money deposited is credited toward his fare. The presence or absence of cabs at every stand in the city is indicated on dials at the office by another automatic device, and each of the machines is provided with a calling-horn and a telephone, by means of which orders are transmitted from headquarters. Cabs summoned by telephone to a customer's home, office, etc., are also sent from the nearest stand by this system. The whole plan insures both economy and efficiency of operation, as it enables cabs to be moved about promptly wherever they are needed, and reduces the total number necessary for the business of the city. It no longer happens, as formerly, that some stands have a long string of

Electrical school, Navy Yard, New York.

idle vehicles, while others, where cabs are urgently wanted, are bare.

The Biological Survey and the Forest Service have been co-operating in the extermination of ground squirrels on national forests in California. The annual loss of range feed and grain crops from ground squirrels is enormous.

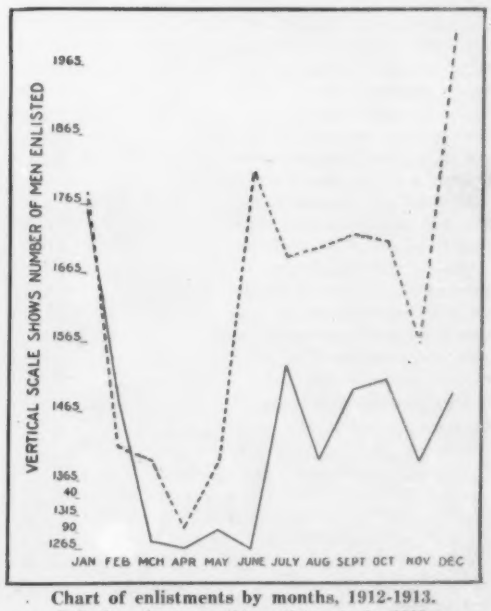


Chart of enlistments by months, 1912-1913.
Full line shows monthly enlistments in 1912. Dotted line shows monthly enlistments in 1913.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Red Coloring Matter of Radishes

To the Editor of the SCIENTIFIC AMERICAN:

I have been investigating the red coloring matter that is found in the skins of radishes and apples and in geranium blossoms. What is its name, and chemical formula?

It is an indicator, orange red in acid solution, and lemon yellow in alkaline. In changing from the red to the yellow it goes through reasonably well defined crimson, purple, and green stages. How do you account for this color change?

It seems to be very sensitive, abundantly found in nature, and easily extracted. Why is it not generally used as an indicator?

I have been unable to find anything about this very interesting coloring matter in any of the botanical and chemical reference books to which I have access, and I hope you can give me a little light on the subject. If no extensive research has been made along this line, I intend to investigate further. A. M. P.

Waxahachie, Texas.

Tapping a Telegraph Cable

To the Editor of the SCIENTIFIC AMERICAN:

The writer is in charge of an engine-room which happens to be built close to where a telegraph cable leaves the shore for England.

Before they enter the cable the telegraph wires are carried overhead from the island post office and pass within five feet of this building.

In the course of experiments the writer found that it is possible, by merely connecting a telephone receiver to any part of the engine and connecting the other terminal to ground, to read the Morse code messages passing on the wires outside.

An iron air pipe connected with the engine and passing overhead, within the building, for about 20 feet and then dropping downward into the earth seems to be the means by which these inductive messages are received.

Having proved the possibility of picking up messages in this way the writer has no further desire to continue the experiment, which is of interest as showing what it is possible to do, sitting inside a building, with no outside connections whatever.

On one occasion a message from the local post office was read, passing to London, announcing the sailing of a certain vessel.

Confirmation of the correct reading of the message arrived a few minutes later, when the ship referred to was seen sailing outward. EDWIN O. CATFORD.

Platte Fougère Lighthouse, Guernsey, England.

The Tide Predicting Machine

To the Editor of the SCIENTIFIC AMERICAN:

In view of the general tone of an article appearing in your issue of March 7th, entitled "A Great Brass Brain," and other articles of like import which have appeared from time to time, I deem it my duty to take this occasion to state publicly that the fundamental conceptions which distinguish this machine from all other tide-predicting machines did not originate with Mr. Fischer, but with myself. So far as comparisons are legitimate, it may be said that my part in the creation of the "new" or "simultaneous" tide-predicting machine is quite analogous to Ferrel's part in reference to the machine which is associated with his name. Mr. Fischer's part was that of a detailed designer rather than that of the original inventor.

One of the items of evidence which may, with propriety, be noted here is the following:

In the Coast Survey Report for 1894 (Part II), pp. 181, 182, I gave a brief description of a machine designed to carry on simultaneously all operations required in tidal prediction. This may be regarded as the first description of the new machine. It was written before the Survey took up the consideration of the construction of a machine. R. A. HARRIS.

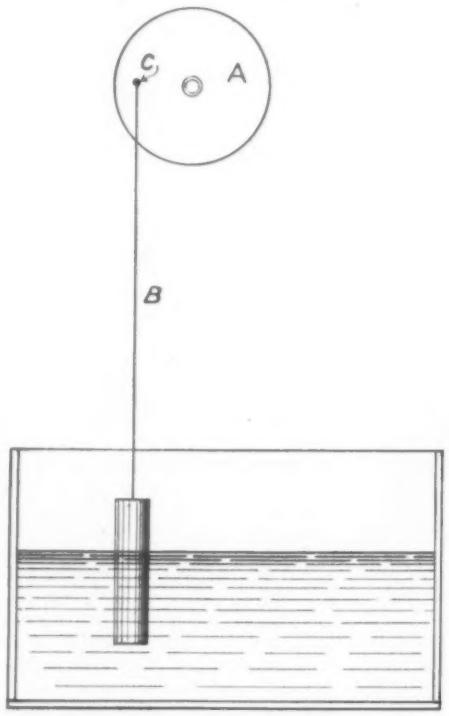
Washington, D. C.

Suggestion for Tide Predicting Machines

To the Editor of the SCIENTIFIC AMERICAN:

I was much interested in Mr. C. H. Claudy's description of the United States tide predicting machine, No. 2, under the heading of "A Great Brass Brain," which appeared in your issue of March 7th. A simple method has occurred to me whereby the construction of such a machine could be greatly simplified, and the chain eliminated, which Mr. Fischer strove to do without success.

Imagine a revolving disk *A* provided with an adjustable eccentric crank *C*, from which hangs a metal cylinder by means of the thread *B*. This cylinder dips into a basin of water or oil or mercury. As the disk revolves the cylinder moves up and down, and the level of the water rises and falls accordingly. This represents one component of the tide, but we may have any



Producing a tide in miniature.

number of these units working independently at the same time to represent the other components. The sum of their varying motions will be exactly represented by the varying level of the water in the basin. In other words, the real tide will be reproduced in miniature in the basin. A graphic record of the tide could be made by means of a float with a stylus attached.

Detroit, Mich. N. P. LEVIN.

Solar Halos

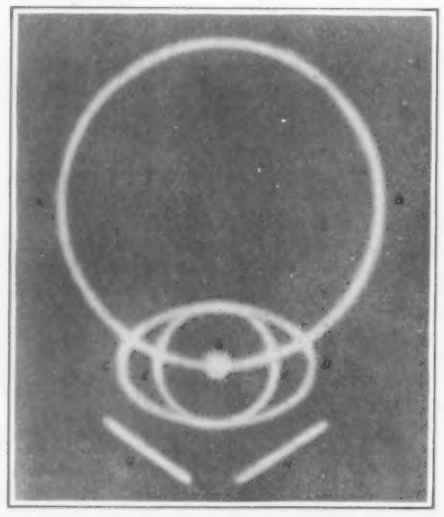
To the Editor of the SCIENTIFIC AMERICAN:

The letter in your paper of February 7th, 1914, from E. C. L. Miller, giving an account of some halos about the sun, recalled to my mind a set of somewhat similar ones that I saw from Nonquitt, Mass., at about 10 A. M. on September 14th, 1900. They struck me as so remarkable that I made a rough drawing of them in my diary at the time, a copy of which I send you.

All the lines were more or less rainbow colored and were especially bright where the lines touched each other. EDWARD M. STETSON.

New Bedford, Mass.

[The study of solar and lunar halos, one of the most interesting byways of science, appears to be enjoying renewed popularity in this country owing to the impression created by the remarkable and widely observed halos of November 1st and 2nd, 1913. This is especially gratifying for the reason that, owing to the comparative rarity and the evanescent character of such phenomena, the perfection of the still fragmentary theory of halos depends upon the collaboration of a large number of painstaking observers. The more persons there are who maintain a vigilant lookout for halos, and prepare accurate drawings and descriptions of those which they see, the greater amount of material will there be for the use of the specialist in dealing with the, at present, obscure questions relating to this branch of optics.



Halos seen on the morning of September 14th, 1900.

S, the sun; *AB*, a large circle parallel to the horizon; *EF*, a circle around the sun; *CD*, an ellipse tangent to *EF* at the top and bottom points; *G* and *H*, two straight rainbow colored lines.

For the encouragement of persons who have a mind to take up halo-observing as a hobby it may be remarked that most varieties of halo are far commoner than they are generally supposed to be, even by meteorologists and physicists. This fact is strikingly illustrated by the records of the Montsouris Observatory, in Paris, where halos are probably observed more assiduously than anywhere else in the world. Thus the commonest of halos —the circle of 22 degrees radius around the sun or moon—was seen at Montsouris on 1,317 days in ten years; an average of one observation every three days. The ordinary parhelia, or sun-dogs, were seen one day in twelve; and the beautiful circumzenithal arc, with its brilliant rainbow colors, one day in 33.

In Mr. Stetson's drawing, herewith, *AB* is the parhelic circle; *EF* is the common 22-degree halo; and *CD* is the circumscribed halo. The lines *G* and *H*, which he has drawn straight, but which really have a slight curvature, with convexity toward the sun, are the extremely rare infralateral tangent arcs of the 46-degree halo; these were observed only twice at Montsouris in ten years.

A comprehensive description, with diagrams, of the known forms of halo was published in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1924, and will be sent to any address for 10 cents.—EDITOR.]

The Canadian Society of Forest Engineers

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of March 28th, you have a little news note in regard to the election of Dr. B. E. Fernow to the presidency of the American Society of American Foresters. In this you say, "This is the only organization of professional foresters in the Western Hemisphere." Will you kindly correct this, as we have also a Canadian Society of Forest Engineers, which was formed in 1906, which has fifty active members and some fifteen associate members, Dr. B. E. Fernow being president; R. H. Campbell, Dominion Forester, vice-president; and myself as secretary.

Grand Mère, P. Q. Canada. ELLWOOD WILSON,
Superintendent of Forestry Division.

Motor Car Speeds and Falling Bodies

To the Editor of the SCIENTIFIC AMERICAN:

The SCIENTIFIC AMERICAN has been the source of much valuable information relating to danger incident to different modes of travel, and since so large a majority of the people now ride (and speed) in automobiles, a hint to them of danger that but few people realize, may interest its readers.

The following computation is designed to compare the speed of an automobile (or other vehicle), as seen by the speedometer registering "miles per hour," with the velocity of a falling body, passing through space at exactly the same rate of speed. From the following table it may be seen that a rate of 40 miles per hour (for example) is exactly the same velocity that a falling body attains from a height of 53.78 feet, under the law of gravity. In other words, a direct impact in a wreck at a speed of 40 miles per hour, is the same as one would sustain by falling 53.78 feet. A striking impression may be afforded any person, by standing on the top of a battlement 53.78 feet high, and contemplating jumping off; and yet, his impact at 40 miles per hour would be the same.

It may be observed from the formula from which this table is computed ($d = 0.03361m^2$) that the danger increases as the square of the number of miles per hour:

d = the height of the fall,

m = the miles per hour one is driving.

Sixty miles per hour (a common boast of "Joy Riders") would be equivalent to a fall of 121 feet.

10	miles an hour	equals a	fall of	3.36	feet
15	"	"	"	7.56	"
20	"	"	"	13.44	"
25	"	"	"	21.01	"
30	"	"	"	30.25	"
35	"	"	"	41.17	"
40	"	"	"	53.78	"
45	"	"	"	68.05	"
50	"	"	"	86.53	"
55	"	"	"	101.67	"
60	"	"	"	121.00	"
70	"	"	"	164.69	"
80	"	"	"	215.10	"
90	"	"	"	272.24	"
100	"	"	"	336.10	"

The danger increases rapidly, especially above 30 miles per hour. S. F. KENNEDY.

The Guns of Panama

The Powerful Defenses at the Terminals of the Canal

By Charles M. Maigne, U. S. A.

THE integrity of the Panama Canal is, of course, of more importance to the United States than to any other country.

Built by money and brains, furnished by our people, the comity of nations demands that its use and benefits be extended to the world at large in the interests of development and commerce; so upon its completion, in time of peace, the great gates will swing open in welcome to any vessel which sails the seas and pays the toll which must be exacted for the maintenance of the waterway. The laws and customs of the civilized world and the precepts of international law are primarily for the preservation of peace, at home and abroad. Peace is the rule and war is the exception, and that the world at large may reap the benefits of the canal the relation of other countries with the United States must be amicable. To the merchant marine and the squadrons of friendly powers, then, the canal stands for peace.

But there is a deeper significance to this country underlying the toil and trouble, the money and men which have gone into the making of this gigantic engineering triumph.

The shifting courses of war may never be forecasted, and it is easily conceivable that from a tiny spark of difference between us and some other first-class power, a cyclone of events and popular opinion might readily fan a blaze of war which would bring to our coastline a foreign fleet, less powerful than our Atlantic and Pacific fleet combined, but superior to either alone.

The successes of the greatest military genius who ever lived, Napoleon Bonaparte, were founded upon dividing an enemy superior in numbers and overwhelming the severed wings in detail. Strategy, whether of the land or sea, has not changed in its fundamental principles with the perfection of modern armament; and to prevent the junction of our Atlantic and Pacific fleets, a foreign squadron, to win its way, must strike promptly and strike hard at the Panama Canal.

Panama Canal is Greatest Naval Strategic Point in Whole World.

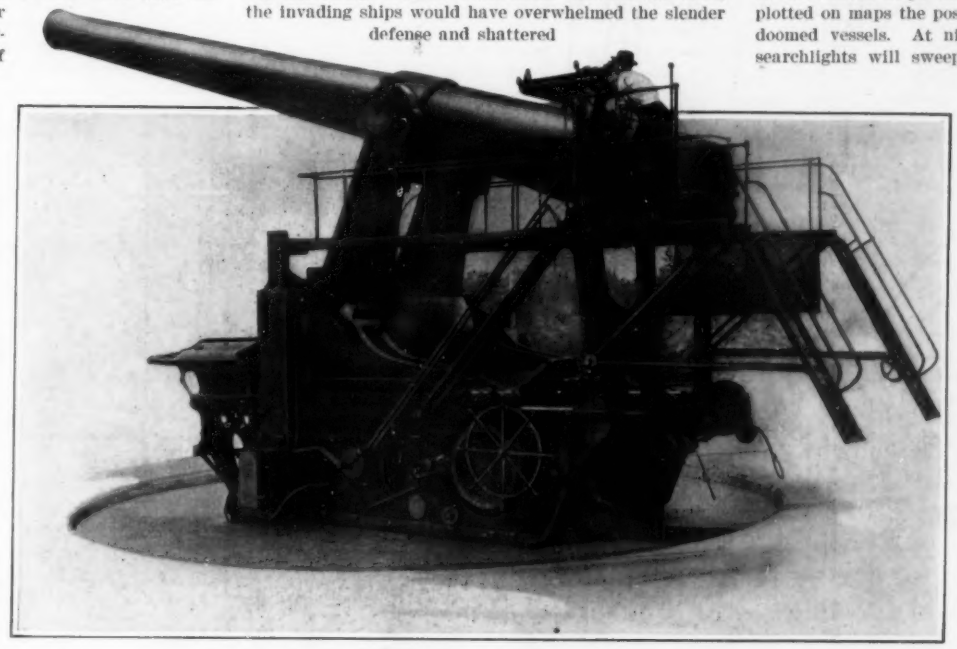
History shows us that the outcome of wars has laid low the might and majesty of many a powerful nation, has even swept the very individuality of a mighty people into an absorption by the conquerors, and left but a tarnished name on its pages to tell of past glories. What has been may be once again. For where would our engineering feats, commerce, wealth, unity, our country, stand if an enemy's mail-shod foot pressed us, defenseless and defeated, into the ground? We should be broken, disintegrated, prostrate at his mercy, our wealth in his coffers, and his flag above our heads. The Panama Canal, the connecting link between our severed squadrons, stands, therefore, in its greatest meaning, to the people of the United States, not for peace, but for war, and to preserve its usefulness to us, against the greatest time of need, it must bristle with guns sufficient to defend it against any possible foe!

To insure that it remains ours we have already shipped to the ports of the Isthmus some hundreds of thousands of tons of steel, wrought into the forms of the mightiest engines of war ever known to man, and with these guns have gone disappearing carriages and ammunition, electrical appliances, and searchlights, shiploads of steel girders and a countless array of cement barrels containing the gray dust from which the concealed gun emplacements will be built.

Suppose the canal were not amply defended. Before the impending crisis of naval battle between the fleets, the invading ships would have overwhelmed the slender defense and shattered it until they could glide into the locks and take their choice of pushing through in an attempt to crush our weaker fleet on the far side, or lay a charge of high explosive within a lock wall or the Gatun dam or wreck the gates, and then decisively defeat our small fleet on this side before our opposite fleet could round the Horn and effect a junction.

Suppose the canal were sufficiently defended. While the foreign fleet was pounding away in a vain attempt to silence our land guns, summoned by wireless, both of our fleets would be hurrying down their coasts to the canal; and, with the army's triumphant guns holding off the enemy, the far fleet would slip through the canal, the junction would be effected, and the enemy crushed by our combined fleets. Let us see how these defending guns will be placed. The plan of the fortifications will not be given out; but ordinary reason tells us that the guns will be about evenly divided between the eastern and western entrances to the canal. The hills near the sea will shadow dun, turf-covered emplacements. Islands, small and large, will each nurse in its breast the sunken mortar pits, also concealed; and it is even whispered that caissons will sink to the bed of sandbars and support artificial islands of concrete and steel in which will be emplaced invisible batteries.

At war's approach, the fairways will be strewn with mines, to be exploded, either on contact with an enemy's hull, or by the pressure of a tiny key in a secluded house, from which telescopes have marked the approach of the hostile ships and where dexterous fingers have plotted on maps the positions in the mine square of the doomed vessels. At night, the quiet fingers of great searchlights will sweep over the mine fields, and an attempted raid by small boats will be checked and crushed by the rapid-fire batteries which guard the planted mines.



Panama Canal Defenses—14-inch breech-loading rifle.

Length, 48 feet; weight, 69 tons; weight of projectile, 1,660 pounds; range, 18,000 yards; penetration, 13 inches.

The guns which will constitute the main strength of the defenses will be of various sizes. Chief among them will rise the giant 16-inch gun, the most powerful in all the world. Then will come the 14-inch rifles, surpassingly deadly, the 12-inch mortars, against whose plunging shells no ship's deck armor may avail, and the 6-inch rapid-fire guns, to cover the mine fields.

In the history of warfare there have been guns of larger bore than that of these at Panama. During the civil war, smooth-bores hurled spherical shells of 20 inches diameter, and there is the well authenticated story of a Turkish gun with a bore of 24 inches; but neither of these guns would have the slightest effect against modern armor, and their range was about equal to that of our 30-caliber rifle, now in the hands of each infantryman.

The range of the 16-inch gun is about twenty-one miles at an elevation of 45 degrees, and the shell that twists its swift way high above the plane of sight weighs 2,400 pounds. There is no armor in the world can withstand the terrific impact of this mighty missile, propelled by a charge weighing 650 pounds.

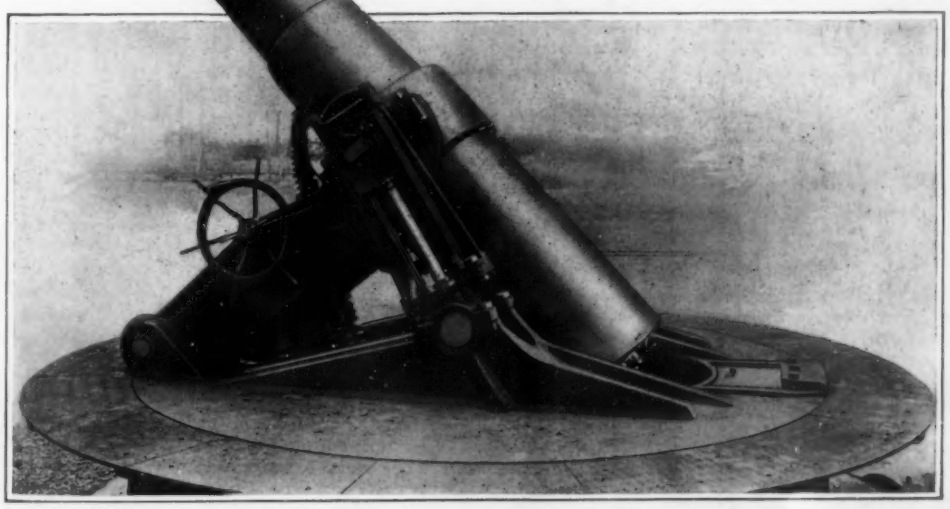
The conical shell itself lacks but two inches of being 6 feet long, is taller than the average man, and it has an average penetration of 17 inches of the hardest armor at all the fighting ranges. There is no such armor afloat. At the muzzle, the shell will penetrate 25 inches of armor.

It requires about sixty men to serve this gun. Of the sixty there are about twenty-five actually operating the gun itself; the remainder are engaged in the necessary occupations of receiving the range and elevation and computing firing data, in telephone service and magazine service, and in supplying the gun with its charges and projectiles. The service rate of fire, sustained in battle, is about one shot a minute, delivered with marvelous accuracy. It is entirely possible to greatly increase the rate of fire; but any such increase will always be at the expense of accuracy, and a discharge of the gun costs far too much to waste ammunition for the sake of a mere record.

One shell from this gun, with the charge, costing about $1,027.50, should it find its billet, as it probably will, would probably disable a battleship costing in the neighborhood of ten millions of dollars. The gun-makers have rather the better of the competition with the armor manufacturers. Ships are now carrying about their limit in steel armor.

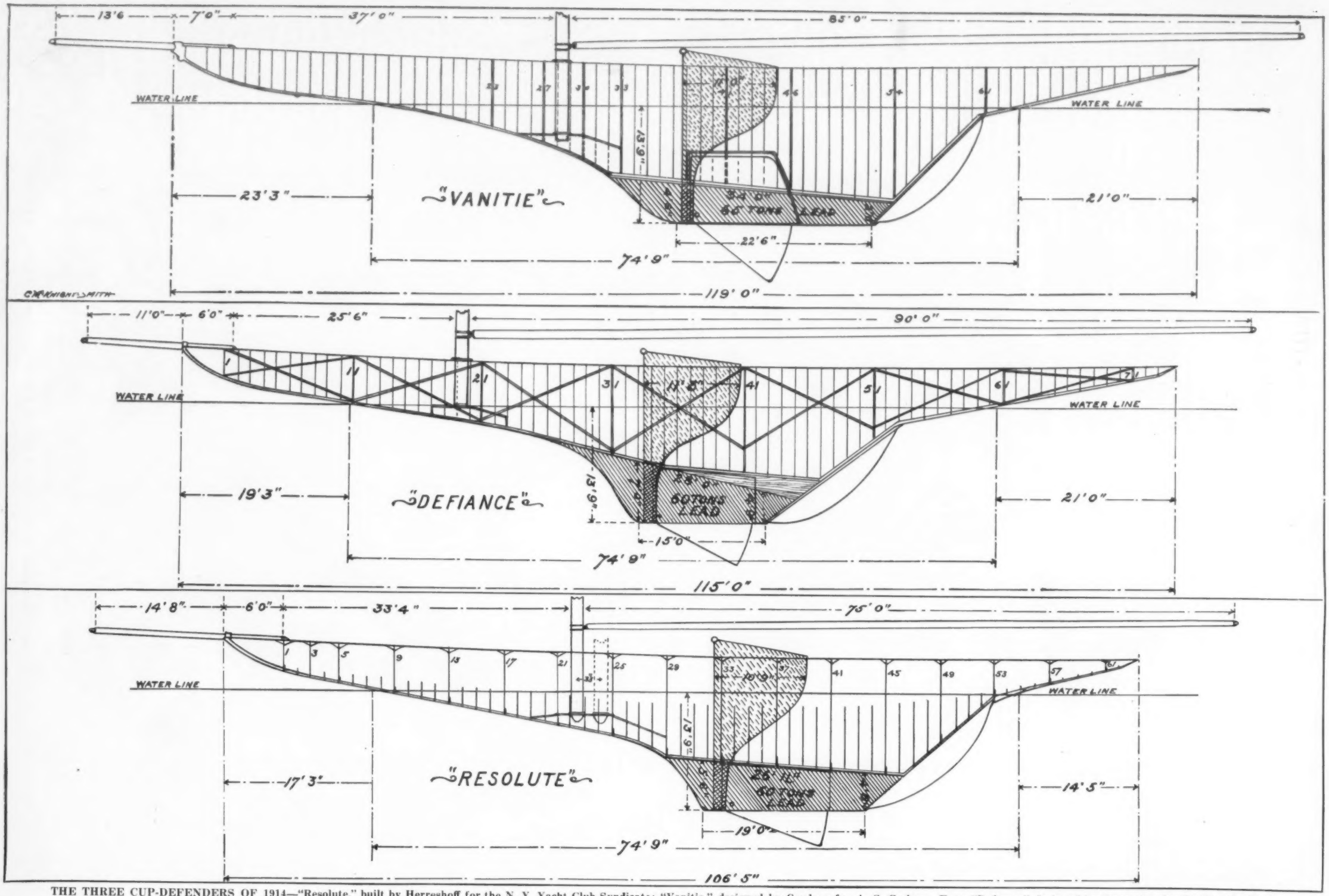
The 14-inch guns, which like the 16-inch, will be

(Concluded on page 385.)



Panama Canal Defenses—12-inch mortar.

Length, 16 feet 8 inches; weight, 17 tons; weight of projectile, 1,076 and 700 pounds; range, 19,000 yards; penetration, any deck armor.



THE THREE CUP-DEFENDERS OF 1914—"Resolute," built by Herreshoff for the N. Y. Yacht Club Syndicate; "Vanitie," designed by Gardner for A. S. Cochran, Esq.; "Defiance," designed by Owen for the Tri-City Syndicate.

The Defense of the "America's" Cup

Construction, Sail Plans and Leading Characteristics of the Three Cup Defenders of 1914

NOW that the British challenging yacht and the three cup defenders are plated up and practically ready for launching, all of them having long passed the stage when any knowledge by the designers of the plans of their competitors, would come too late to have any effect upon the final issue, the SCIENTIFIC AMERICAN takes much pleasure in presenting to its readers the first authentic information regarding the three cup-defending yachts. That so much authentic technical information should be available for publication upon a subject in which the American public is so vitally interested, is an encouraging sign of the times. The old policy of maintaining profound secrecy, long after it has ceased to be necessary, has happily passed away, and the public is to be congratulated on the more liberal and sportsmanlike policy which recognizes the widespread national interest in the struggle for the "America's" cup.

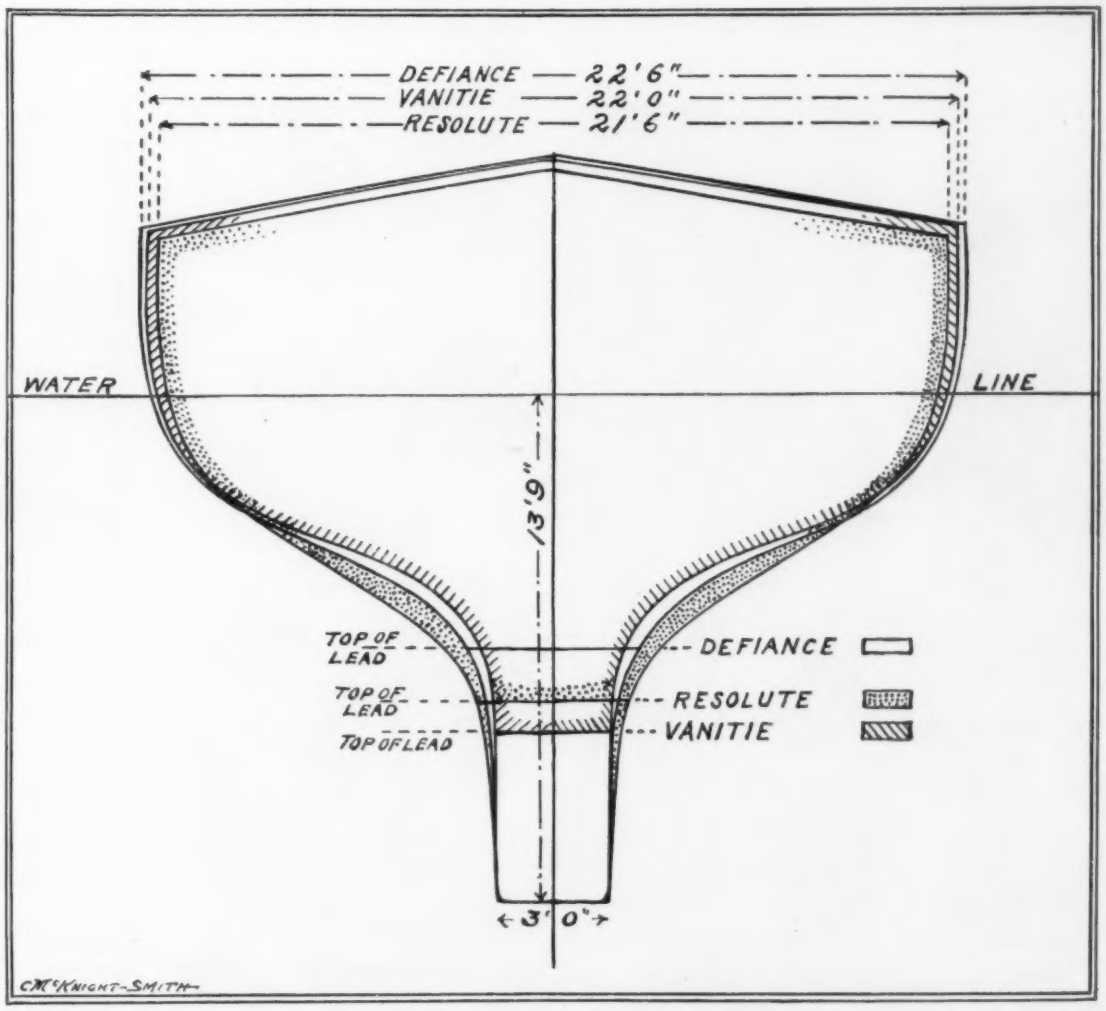
New Rule of Measurement.

The three yachts have been designed under the new rule of measurement which will govern this year's series of races. This rule was drawn up with the object of correcting the defects of the old rule. Under the old rule there was a tax on waterline length and sail area and on nothing else. Provided the yacht did not exceed 90 feet on the waterline, the designer might make her as broad, as deep, and as long on deck as he pleased; and he was at liberty to give her as large a sail plan as he wished. In determining the rating of the yacht, that is, the allowance she must give to or receive from a competitor, the waterline length and the sail area, only, were taken into consideration. The greater her waterline length, the larger her sail area, the greater would be the allowance which she had to make over a 30-mile course to her competitors. These were the only restrictions. Working under this rule, it was found that a yacht with a broad, shallow and generally scow-shaped hull, with long overhangs, carrying a great mass of lead at the bottom of a deep keel, and driven by a vast spread of sail, produced the fastest yacht under the average weather conditions off Sandy Hook. The most extreme yacht built under the rule was the "Reliance," which, on a waterline length of just under ninety feet, was over one hundred and forty feet in length on deck, and spread the enormous sail area of over sixteen thousand square feet of canvas. The bilges were hard and carried well out into the ends, the turn at the garboards from the floor into the keel was sharp; and it was the boast of Nat Herreshoff, her designer, that the "Reliance" had the largest sail area in proportion to the wetted surface of the hull of any yacht that had ever been built.

The racing yachts built under this rule lost their usefulness as soon as the cup contests were over. Their spars were too big, and their hulls too shallow, and their draft too great, to render them useful as cruisers; and most of those which were built for the last four series of races had to be broken up and sold for junk.

The changes introduced under the new rule were in the direction of producing a more wholesome boat, with a larger displacement, a smaller draft, a sweeter form with sharp ends—a form which would have a much easier motion in a seaway than the old scow form, which pounded heavily and was extremely wet in going to windward in a short sea.

A comparison of the cross sections of the three challengers of the present season shows the modifying effect of the new rule. The bilges are easy, the deadrise of the floor is steeper and the turn into the keel at the garboards is much fuller than in the yachts built under the old rule. The new rule favors displacement; that is to say, the yacht with the larger displacement, other things being equal, will have the smaller rating and the larger time allowance. Considered from every point of view, the cup yachts of the season 1914 are much abler and more satisfactory sea boats than their predecessors of the last four or five contests for the cup. Although the construction is very light, the materials have been so well disposed that the yachts are amply strong for the work they will have to do. Moreover, they will be available, when the races are over, for the regular yacht club regattas which are annually held on our coasts. If their future owners wish to turn them into cruisers, there is sufficient head room to enable the interior of their hulls to be bulkheaded and furnished with the necessary cruising accommodations. A reduction in sail plan can be made without any serious reduction of the speed, and the boats can be handled, under this reduced rig, with crews of moderate size.



Midship sections of the cup-defenders.

Points of Similarity and Difference.

In respect of two of the principal dimensions the three yachts are alike. Each is 74 feet 9 inches in length on the load waterline, and the draft of each is 13 feet 9 inches. Also, there is not much difference in the beam, only one foot, in fact, between the narrowest, "Resolute," and the widest, "Defiance," whose width is, respectively, 21 feet 6 inches and 22 feet 6 inches. "Vanitie" comes between with a beam of 22 feet.

Of all the drawings, the most interesting and instructive is that showing the midship cross sections superimposed. From this it will be seen that "Resolute" has the fullest and deepest underwater body, with an easy bilge, steep floor, and a full turn from the floor at the garboards into the keel. "Vanitie" shows the least departure from the yachts built under the old rule; and, of the three boats, her bilge is harder, her floor flatter, and she is more cut away at the garboards, where the turn from floor to keel is rather sharp. "Defiance" shows a cross-section midway between the two. The effect of these midship sections is shown in the other dimensions of the hulls. Thus "Resolute" has much shorter overhangs than the other two boats, both forward and aft, her over-all length on deck being only 106 feet 5 inches, as against 115 feet in "Defiance" and 119 feet in "Vanitie." Speaking broadly, it may be said that while the differences in midship section are not very great, "Vanitie" suggests something of the U-section and "Resolute" the V-section, with the "Defiance" midway between the two. There is probably not much difference in the displacement of the three yachts, which is something over one hundred tons. The Gardner boat, "Vanitie," with her harder bilges shows a more powerful form than Nat Herreshoff's "Resolute," and in reaching and running, or at any time with sheets started, she should be the faster boat. In windward work, and particularly in a confused sea, we should incline to favor the chances of "Resolute."

The most interesting feature of difference in the three yachts is the sail plan, and it will come as a matter of surprise that the Herreshoff boat carries a spread of sail which is surprisingly less in area than that of the other two yachts, the "Resolute" spreading 8,188 square feet, "Vanitie" 9,465 square feet, and "Defiance" 9,819 square feet, or 1,631 square feet more than the Herreshoff boat. The modern tendency to make the rig lofty and relatively narrow is shown in the sail plan of each yacht, and this is particularly noticeable in "Defiance." "Resolute" on a base line of 131 feet has a vertical height from main boom to topmast truck of 125 feet; "Vanitie" on a base of 144 feet 6 inches shows a vertical height of 131 feet, whereas "Defiance" on a base line of 134 feet 6 inches has the enormous height of 146 feet. Both "Resolute" and "Vanitie" carry double headsails, and the division of the base line for the forward and after triangle is about normal practice. In "Defiance," however, the mast has been stepped far forward, and the bulk of the sail area is concentrated in the mainsail. Her boom has the enormous length for a 75-footer of 90 feet, as against 85 feet in "Vanitie" and 75 feet in "Resolute." From the forward side of the mast to the end of the bowsprit of "Defiance" is 42 feet 6 inches, as against 54 feet in "Resolute," and 57 feet 6 inches in "Vanitie." It is needless to say that "Defiance" carries only a single headsail.

The concentration of so much of the sail area in one large mainsail has been favored by George Owen, the designer of "Defiance," in the expectation of securing fine weatherly qualities in going to windward. Theoretically, "Defiance" should point high and foot fast while doing so; but, as everyone who has handled the wheel or tiller of yachts rigged in this fashion knows, she is liable to be a very difficult boat to steer. The

DIMENSIONS, ETC., OF THE THREE CUP DEFENDERS.

	Resolute.		Vanitie.		Defiance.	
	Ft.	In.	Ft.	In.	Ft.	In.
Length over all	106	5	119	0	115	0
Load waterline	74	9	74	9	74	9
Draft	13	9	13	9	13	9
Beam	21	6	22	0	22	6
Forward over-hang	17	3	23	3	19	3
After over-hang	14	5	21	0	21	0
Mast, deck to cap	94	0	95	0	105	0
Topmast, cap to truck	35	0	40	0	45	0
Boom	75	0	85	0	90	0
Gaff	50	0	52	0	56	0
Bowsprit, outboard	14	8	13	6	11	0
Sail area	8,188 sq. ft.		9,465 sq. ft.		9,820 sq. ft.	

possession by "Defiance" of this rig will lend a special interest to the long series of contests which will take place during the present season between these three boats, to determine which of them shall be selected to meet Sir Thomas Lipton's "Shamrock IV."

Construction of the Yachts.

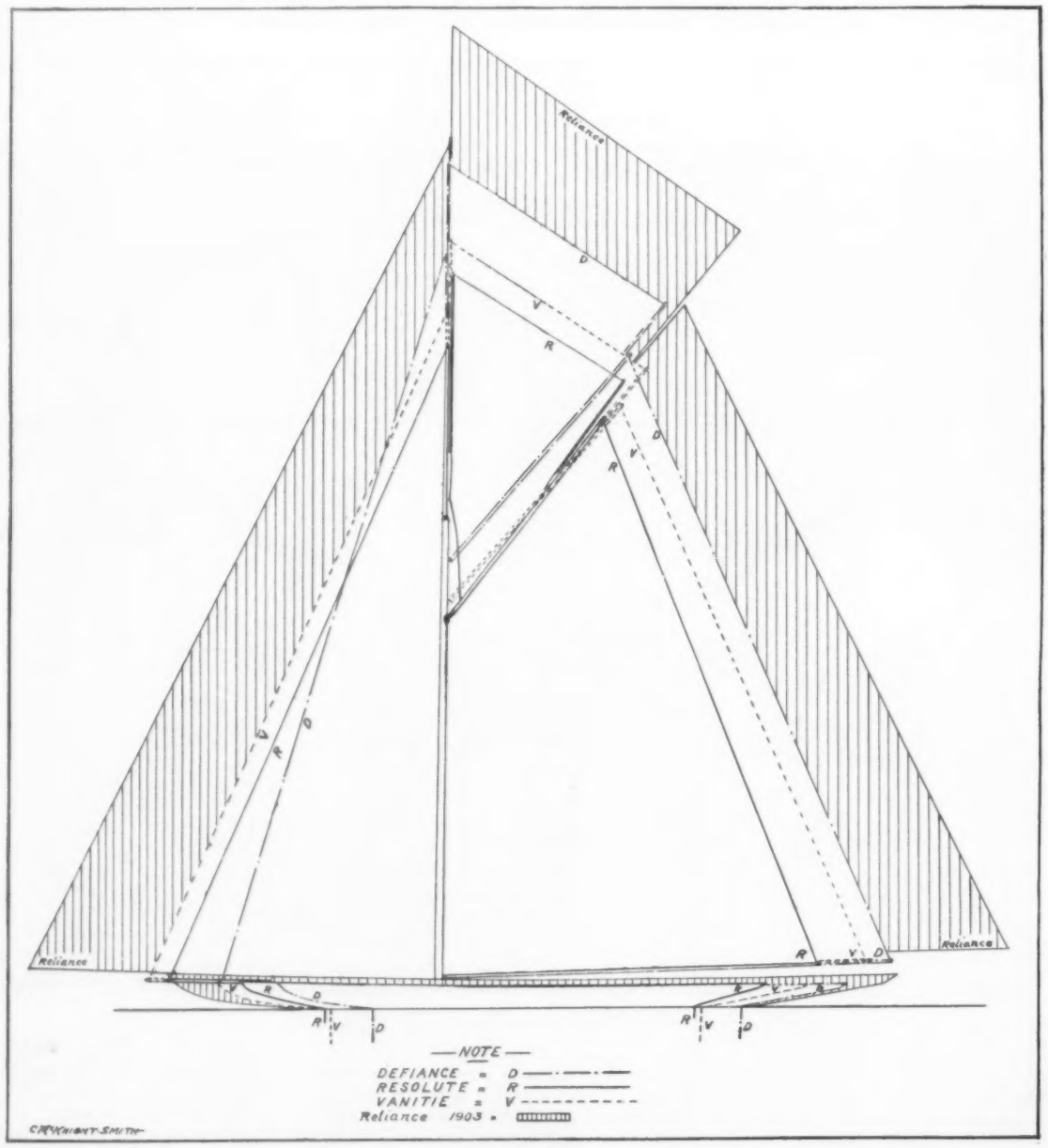
"RESOLUTE"—The construction of "Resolute" follows in general that type which Herreshoff originated in "Constitution" and "Reliance." It consists of a series of deep web-frames varying in depth from 8 to 12 inches, with lighter frames between, and longitudinal framing following the line of the seams of the bronze plating. The plating is laid on with flush seams and butt joints. It consists of 5/32 inch manganese bronze, and the lowest or garboard strake overlaps the lead 2 feet, the lead being covered with brass sheeting 1/32 inch thick. Intermediate with the deep web frames, which extend entirely around the hull, are shorter and lighter frames, three between each web. There are two mast steps, spaced 33 inches apart, center to center. The mast is built of nickel steel, stiffened with 2¼ by 1⅛ inch bulb nickel stiffeners. It is 20 inches in diameter at the foot. The topmast, 12 inches in diameter, is of wood, and it foots upon a steel cone within the steel mast and 5 feet below the cap. The lead keel is placed between web frames 29 and 45. It measures 26 feet 11 inches on top and is 4 feet 6 inches deep at the heel and 5 feet 6 inches deep at the nose. The length of the lead on the bottom is about nineteen feet. The "Resolute" is decked with aluminium plates 7/32 of an inch thick, the whole deck being covered with canvas, sanded.

"VANITIE"—The framing of "Vanitie" consists of web frames 10 inches deep, eight in all, which are spaced as shown in the drawing. The framing extends from the keel plate up to the covering boards, and consists in addition to the web frames of 3-inch by 1¾-inch L-angles. The "Vanitie" is plated with manganese bronze, which varies from 3/16 of an inch to 7/32 of an inch in thickness.

The mast is a hollow steel spar 20 inches in diameter, and the mast step is located between the web frames on stations 27 and 30. The lead keel measures 34 feet on top, and it is 2 feet 10 inches deep at the heel, and 4 feet 6 inches deep at the nose. It is secured to the hull on web frames 33, 41, 46, and 54.

"DEFIANCE"—The hull of the "Defiance" is constructed of steel framing, overlaid by two thicknesses of wooden sheathing. There are 73 frame stations, and every tenth station is a deep web frame. This framing is tied together with diagonal straps, 3/16 inch thick by 6 inches wide, riveted to the outside of the frame. The inner sheathing of the hull consists of ¾ inch fir, and this is bolted to the frames with bronze bolts. Upon this is placed the outer skin of mahogany, 1¼ inch thick, which is fastened to the inner skin with bronze screws from the inside. The deck plating is of pine. The lead bulb is 4 feet 9 inches deep at the heel and 7 feet deep at the nose, and it measures about 28 feet along the top.

The "Resolute," designed by Herreshoff, has been built by him at Bristol; the "Vanitie," designed by William Gardner, was built by George Lawley & Son, at Neponsett; and the "Defiance," designed by George Owen, was built by the Bath Iron Works, at Bath, Maine.



A comparison of sail plans.

French Artificial Wood.—Information has been made public in Lyons, France, concerning an artificial wood, which, it is stated, will be of great value as a substitute for natural wood. The new product has been found after years of study and practical experiments, the most recent of which have given eminently satisfactory results. The process consists in transforming straw into a solid material having the resistance of oak. The straw after being cut into small pieces is reduced to a paste by boiling, to which certan chemicals are added. When the paste has been reduced to a homogeneous mass it is put into presses, and planks, beams, laths, and moldings of all sizes are readily made. This new material can be sawed like natural wood. As a fuel, it emits a bright flame and little smoke. It is further stated to be adaptable to the manufacture of match stems.

How Bubonic Plague Reached Porto Rico

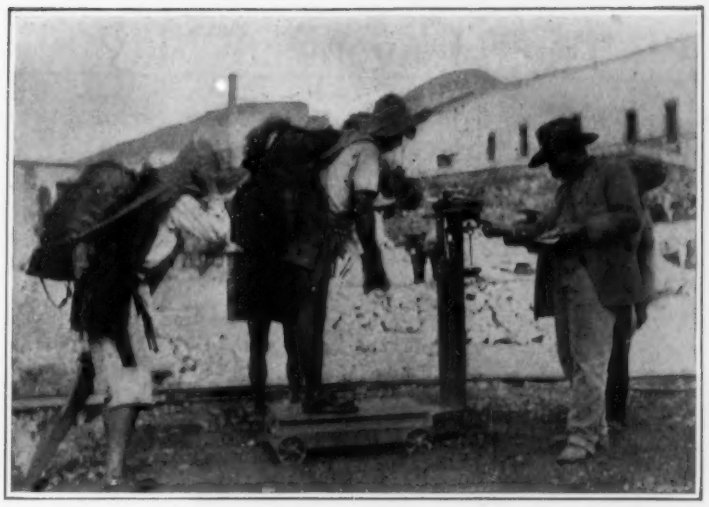
IT will be recalled that an epidemic of bubonic plague occurred in Porto Rico in the summer of 1912, throwing the whole island into a panic and paralyzing business, but fortunately resulting in only a small loss of life, owing to the very prompt and energetic measures taken by the health authorities. The source of this epidemic is revealed in the last report of the Government of Porto Rico, and the revelation constitutes a serious charge against an official health service in another quarter of the world. At first it was suspected that plague had entered the island through the medium of certain shipments of maize from Venezuela, the sacks containing infected rats. Another conjecture was that it had come from the United States on a ship in which two infected rats were found. Ultimately, unmistakable proof was adduced that the infection had been received from the Canary Islands. An epidemic of plague had occurred in the latter islands some time before the first case appeared in Porto Rico, but the Spanish authorities had concealed the fact from the world. Moreover, the health officials in the Canaries have naively admitted that plague had existed there for years, but they thought it best not to divulge the fact! Meanwhile vessels from the Canaries had been allowed to dock freely, without quarantine, at San Juan and at other ports throughout the world.

The Current Supplement

THIS week brings the two thousandth issue of our SUPPLEMENT. Among the principal articles appearing therein is the account of Dr. Bridgman's experiments on water at pressures of 20,000 atmospheres, or 300,000 pounds per square inch. These experiments have brought to light the interesting fact that in addition to the two kinds of ice previously known to science, there are three more, five in all.—Dr. V. Cornish contributes a most interesting article on the dimensions and velocity of ocean waves.—The second instalment of the account of the London Aero Show appears in this issue, accompanied with thirty-two descriptive illustrations.—What is the smallest object visible to us on the moon? This question is answered by Abbé Moreux for our readers.—A thousand-ton forming press for large metal objects is illustrated and described.—C. H. Bromley explains how a carbon dioxide absorber for the automatic registration of flue gas analysis works.—The nature and prevention of dust explosions in coal mines and factories is discussed in detail.—The temperatures in the various parts of a steam plant are traced from furnace to condenser.—Dr. J. H. Barach suggests a dynamic index which measures heart action.—What generator and accumulator equipment is recommended for different circumstances for country house electric power plants? The reader will find this question answered in a special article.—Diagnosing diseases in patients 1,500 years old—such is the task which Dr. Ruffer has set himself. A note on his work will be found on the last page of this issue.

Primitive Mining in Mexico

WEIGHING a miner and his load together is the method used by a Mexican company to ascertain the quantity of ore brought to the surface. Of course the weight of each man and his outfit is noted in the weigher's memorandum book, so the amount of ore is figured at a glance. The methods of bringing the ore to the surface are primitive, indeed, compared to the electric hoists used in mines of modern equipment. The group of peons with their rough baskets filled with ore is eloquent of the cheapness of human labor in the mines of our neighboring lands to the south. In some old workings the loads are still raised by the Mexicans, who climb to the shaft's mouth by ladders, bearing heavy baskets or sacks on their shoulders.



To guard against theft, miners in Mexico are weighed with their load of ore.

Teaching Swimming With Trolleys

A NEW system of teaching boys and girls how to swim has been instituted in certain Cincinnati schools equipped with bathing pools. An apparatus is employed consisting of an oval track secured to the ceiling over the pool. A dozen trolleys run on the track, and from each depends a rope with a belt attached. Twelve pupils fasten the belts around their waists and the swimming lesson is on. They go through the motions of "sailor fashion" and the "Australian crawl" as per the direction of the swimming instructor, who keeps watch from around the edge of the pool. They cannot sink, so the only thing remaining for them to do is to swim. This "water-merry-go-round" has proven so successful that others like it are to be installed in schools where a bathing pool is a part of the equipment.

A trolley swimming lesson.

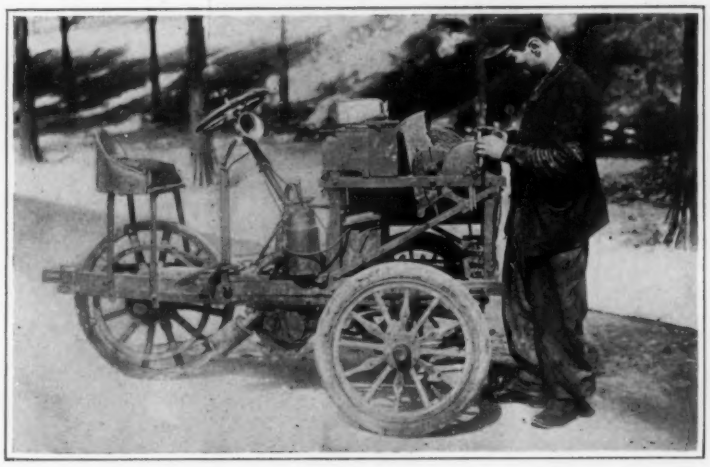
Motor Car Locomotive

RECENTLY we illustrated in these columns a touring car used for passenger transportation on a small western railroad. Pictured herewith is another car used for a similar purpose, and also acting as a locomotive for a freight train. It furnishes daily service from Westmoreland to Blaine, Kansas. The rear wheels of the automobile are fitted with flanges to fit the track rails, and the front wheels have been replaced by a four-wheeled swiveled truck. This motor-car locomotive is able to haul three small freight cars. The picture shows the train loaded with six tons of freight.

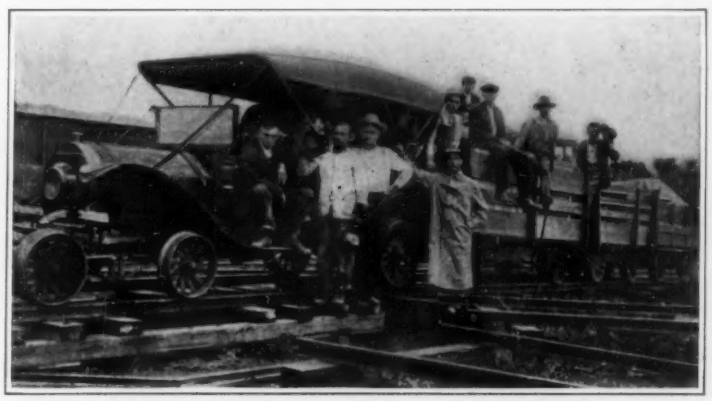
Up-to-Date Scissors Grinder

IT has often been said that the advent of mechanical operation has killed the small industries, but recent developments in engine design, especially the construction of gasoline engines, are bringing about an opposite tendency, and the individual artisan frequently finds a powerful help in the adoption of such motors for driving his tools, or operating a dynamo which in its turn supplies current to a number of small electric motors.

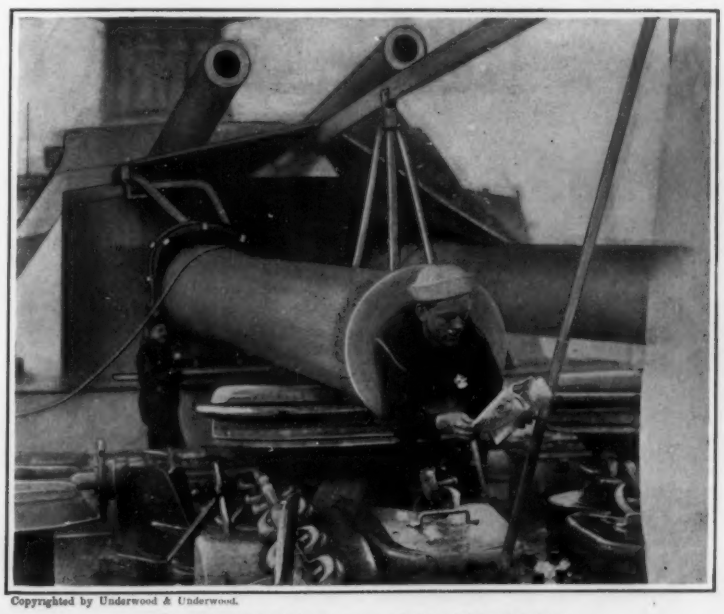
That even the most humble workman may derive profit from the use of machinery is strikingly shown by the accompanying photograph of a clever scissors-grinder who has recently fitted his grindstone with a gasoline motor enabling him to carry out his work more rapidly and efficiently than his competitors. Not only does the engine propel his machine, but it also turns his grindstone for him.



Scissors-grinder's home-made motor car and power grinder.



Combination freight and passenger train hauled by motor car.



Copyrighted by Underwood & Underwood.

The forward 14-inch guns of the "New York."

England's Oldest Fire Engine

PICTURED in the accompanying engraving is a relic of early fire-fighting apparatus, which is claimed to be the oldest fire engine in England. It is kept in the verger's vestry in Malmesbury Abbey. The engine is said to have been built in the year 1700, and saw nearly a hundred and fifty years of service. It was last used at a fire in Burton Hill House in 1845. In those days things were built to last and machines were not scrapped, until beyond repair. As the photograph clearly shows, it is a hand-pump adapted to draw water from tanks at either side of the pump cylinder, which was located at the center of the machine. These tanks were kept filled by a bucket brigade.

Fire engine of the eighteenth century.

The 14-inch Guns of the "Texas" and "New York"

ON opposite sides of one of the piers at the Brooklyn Navy Yard, and exactly abreast of each other, are the two latest additions to our Navy, the dreadnoughts "New York" and "Texas," the former built by the Government at the Brooklyn yard, and the "Texas" recently from the hands of her builders at Newport News. Both ships are receiving their finishing touches before sailing for Mexican waters. The most interesting and novel feature about these ships is their main armament, which, in the case of each ship, consists of ten 14-inch guns. The 14-inch gun has never before been mounted on a ship of our Navy. Preceding the "New York" and "Texas" were the "Wyoming" and "Arkansas," and each of these ships carries twelve 12-inch guns in six turrets. Although the "New York" and "Texas" carry less guns by two, they have a heavier broadside, for the increase of two inches in the caliber means a very large increase in the power of the guns. The 45-caliber, 12-inch gun fires a shell weighing 870 pounds with a muzzle energy of 48,984 foot-tons, and it can penetrate 15.2 inches of Krupp armor at 10,000 yards. The 50-caliber 12-inch gun, which is, of course, five feet longer than the one just mentioned, fires an 870-pound shell, with a muzzle energy of 61,644 foot-tons, and it can penetrate 15.6 inches of armor at 10,000 yards. The 45-caliber 14-inch gun fires a 1,400-pound shell with a muzzle energy of 65,687 foot-tons, and at 10,000 yards it will penetrate 15.9 inches of Krupp armor. The penetration, it will be observed, is very little greater than that of the 12-inch, but the bursting charge of high explosive contained in the 14-inch shell is very much larger.

The Heavens in May

The First Comet of 1914, and Its Orbit

By Henry Norris Russell, Ph.D.

THE first comet to be discovered in 1914 was detected by Dr. Kritzinger of Bothkamp, Germany, on March 29th. It was then on the borders of Scorpio and Ophiuchus, in 16 hours 12 minutes right ascension and 9 degrees 30 minutes south declination, was moving northeastward about 1 degree a day, and was visible in a small telescope. Further observations were promptly secured, and the elements of the orbit have been calculated by Prof. Crawford and Miss Levy of the University of California, and by Prof. Kobold of Kiel. The two sets of elements are in very close agreement, and show that the comet will be nearest the Sun on May 31st, at a distance of 1.255 astronomical units, or 117 million miles. It is moving around the Sun in the same direction in which the planets go, and the plane of its orbit is inclined only 25 degrees to that of the ecliptic.

The circumstances of its apparition are shown in the accompanying diagram. The comet's orbit must be supposed to lie above the plane of the paper on the left of the line of nodes, and below it on the right—its greatest height above this plane being equal to about half the diameter of the Earth's orbit. The positions of the comet and the Earth at the beginning of each month are joined by lines drawn on the diagram. It is easy to see why it was not discovered earlier, for, a month or two before it was first seen, it was farther from the Sun and Earth (and hence much fainter) and also much farther south in the heavens.

All through April the Earth gains on the comet, while the latter approaches the Sun, and the combination of these changes causes a rapid increase in its brightness.

During May it will be at its best; then it will slowly recede from us and from the Sun, and gradually fade away, though it will be brighter than it was at the time of discovery until the end of August.

The best available ephemeris of its motion now at hand stops on April 30th, on which date its predicted position is in 18 hours 6.5 minutes right ascension and 15 degrees 18 minutes north declination. At this time it is moving 4 minutes eastward and 1 degree northward per day, and its rate of motion is gradually increasing. Allowing for this, it appears that on June 1st it will be in about 20 hours 20 minutes right ascension and 46 degrees north declination; but these are only rough estimates. Its path among the stars lies in Hercules, Lyra, and Cygnus. On May 15th it will be about half-way between β Cygni and β Lyrae.

At the time of discovery it was visible, though not conspicuous, in a small telescope. It will be five or six times as bright as this in May, but it is not at all likely to be visible to the naked eye. Even at the time of discovery, it showed a very faint tail, 40 minutes in length, and when nearest the Sun it will doubtless have a longer one, and be a pretty telescopic object.

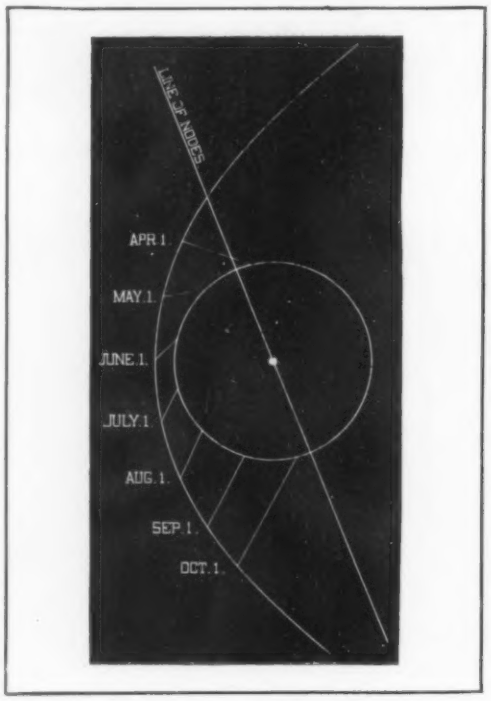
Delavan's comet, which is still behind the Sun, and almost unobservable, was brightening up rapidly when last seen, and will probably be conspicuous in the autumn.

The Heavens.

The student of our evening skies may well begin this month by looking right overhead. There, so high that at a first glance he seems almost in the zenith, is the great red star Arcturus, one of the most splendid objects in the heavens. He is conspicuous to the eye for three things, his great brightness, his isolation—no other star at all comparable in brightness with him being within 30 degrees distance—and his red color. Viewed with the telescope his brightness and color are, of course, far more impressive; but, even with the most powerful instruments, he remains but a point of light, showing no sign of duplicity, either to direct observation or to the spectroscope. Measurements of his position in the heavens show, however, that he is moving southwestward among the other stars, at the relatively very rapid rate of 2.28 seconds per year. Since the time of Ptolemy, he has moved through more than a degree. This may seem a very small change to happen in 1800 years; but when we pass from the apparent to the real motion of the star, we come upon a speed which no one could call slow.

The parallax of Arcturus, according to the final result of the long series of measurements made at Yale, is 0.075 second. That is, its distance is 2,750,000 times that of the Sun, or 43 light-years, and we see it now as it was in 1871.

Upon computing its actual rate of motion, we find it to be 90 miles per second, or in more familiar units, 324,000 miles per hour. Spectroscopic observation shows that this motion is almost exactly at right angles to our line of sight toward the star; the rate at which



Orbit of Kritzinger's comet.

it is approaching us is between two and three miles per second.

If removed to the distance of Arcturus, our Sun would appear as a star of the fifth magnitude, just comfortably visible to the naked eye. Even the dazzling Sirius, if set beside Arcturus, would appear as a relatively faint companion, only one fifth as bright as he; for Arcturus is 115 times as bright as the Sun.

Why should this star be so bright? Is it because of its great size, or of high intrinsic brightness of its surface? A pretty definite answer can now be given to this natural question. Arcturus is a red star, and both the color of his light and the behavior of certain lines in his spectrum afford very good reason to believe that his surface is not as hot as the Sun's, though still probably hotter than the hottest electric furnace. If his surface is cooler than the Sun's, it will give out less light and heat per square mile; according to the best estimate we can make, from one third to one fourth as much. But it gives out altogether 115 times as much light as the Sun; so it must have somewhere between 350 and 450 times as many square miles in its surface as the Sun has; that is, its diameter must be not far from 20 times that of the Sun.

Though Arcturus must exceed the Sun in bulk several thousand times, it is very improbable that he surpasses the Sun in mass to at all the same degree. We have no way of getting at the facts in this particular case; but in many similar cases it can be shown that stars of similar brightness, color, and probable diameter contain but a few times as much matter as the Sun. Such stars are of very low density—sometimes not more than that of air—and must be huge masses of rarefied incandescent gas. It may be hard to believe that a mere mass of hot air, however big and hot, could shine far more brightly than the Sun. But air is not quite the perfectly transparent substance that we suppose. Ten miles of it will cut out fully one quarter of the intensity of a beam of light, even on the clearest days; and, at this rate, a thousand miles of air would be practically opaque, and five thousand miles of it would quite conceal the Sun. A ball of gas, millions of miles in diameter, seen from a great distance, would behave like an opaque sphere, except at the very edge, and, if heated, would shine brilliantly.

Below Arcturus, rather to the right, we see Spica, in Virgo, which looks fainter than Arcturus, but must be at least four times as far off, and is really much brighter. Lower down is Scorpio, some of whose stars are still more remote and equally bright or brighter.

Due south, almost on the horizon, appears a part of the southern constellation Centaurus. Its two brightest stars, α and β Centauri, the former our nearest neighbor in space, can now be seen close to the horizon from points in Florida and southern Texas.

Ophiuchus and Serpens fill the southeastern sky, while on the east are Aquila, Cygnus and Lyra, with Hercules and Corona above them. Cassiopeia and Cepheus are low in the north, Draco and Ursa Minor are above the Pole, and Ursa Major is high in the northwest. Castor and Pollux are near setting in the westnorthwest, and Leo is higher up in the west.

Hydra, stretching far along the southwestern horizon, brings us back to our point of departure.

The Planets.

Mercury is in conjunction with the Sun on the 17th, and is practically invisible this month.

Venus is evening star in Taurus and Gemini, setting about 8:30 P. M. on the 1st, and 9:25 on the 31st. She is in conjunction with Saturn on the 15th, the two planets being a little more than 2 deg. apart.

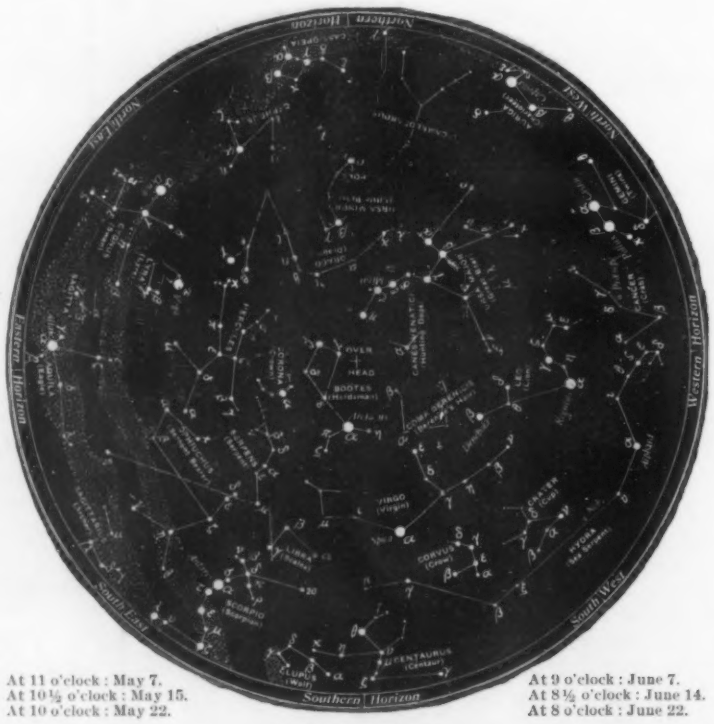
Mars, too, is an evening star, in Cancer, moving steadily eastward, receding from the Earth, and growing fainter, so that he seems now to be only one third as bright as Saturn. He remains in sight till after midnight, except at the end of the month.

Jupiter is a morning star in Capricornus. On the 12th he is in quadrature with the Sun, but being far south does not rise until 1 A. M.

Saturn is evening star in Taurus, setting at 8:30 P. M. in the middle of the month. Uranus is in Capricornus, and comes to the meridian about 5 A. M. on the same date. Neptune is in Gemini and is observable in the early evening.

The Moon is in her first quarter at 1:29 A. M. on the 3rd, full at 4:31 P. M. on the 9th, in her last quarter at 5:12 P. M. on the 16th, and new at 9:35 P. M. on the 24th. She is nearest us on the 8th, and farthest away on the 21st. She passes near Neptune on the 1st, Mars (rather closely) on the 2nd, Uranus on the 15th, Jupiter on the 16th, Mercury on the 25th, Saturn on the 26th, and Venus on the 27th, and returns to Neptune on the 29th and Mars on the 30th.

Princeton University Observatory.



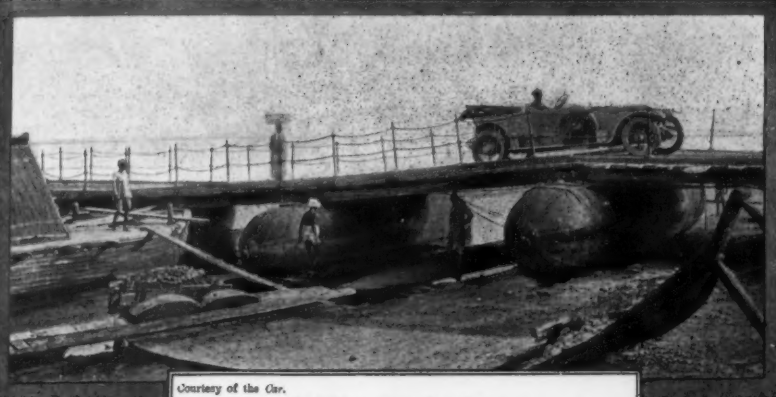
At 11 o'clock: May 7.
At 10½ o'clock: May 15.
At 10 o'clock: May 22.

At 9 o'clock: June 7.
At 8½ o'clock: June 14.
At 8 o'clock: June 22.

At 9½ o'clock: May 30.

NIGHT SKY: MAY AND JUNE

Curiosities of Science and Invention



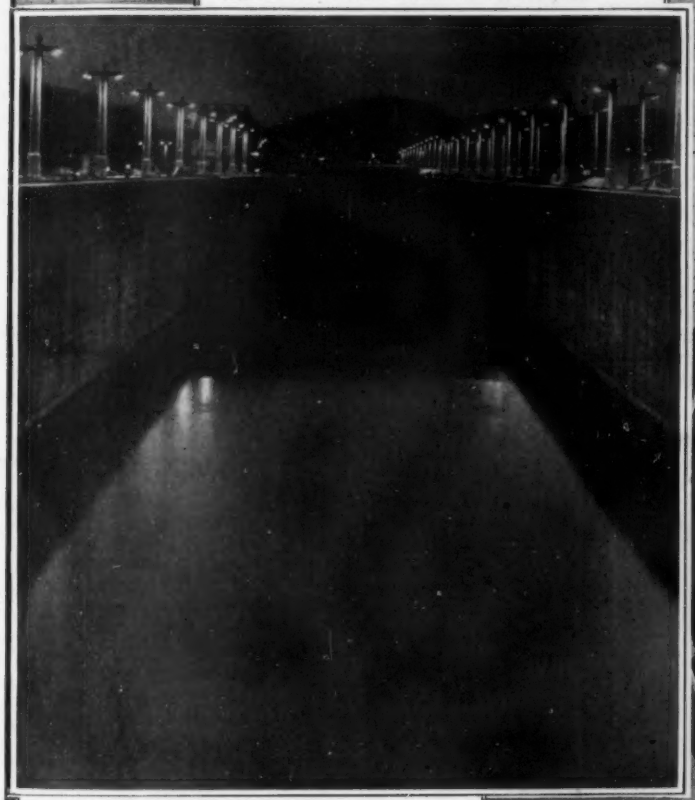
Courtesy of the Car.

Motoring over the Ganges.

One of the two curious bridges at Allahabad. The roadway is supported on substantial pontoons consisting of large metal tanks. The bridge accommodates itself to the seasonal rise and fall of the river.

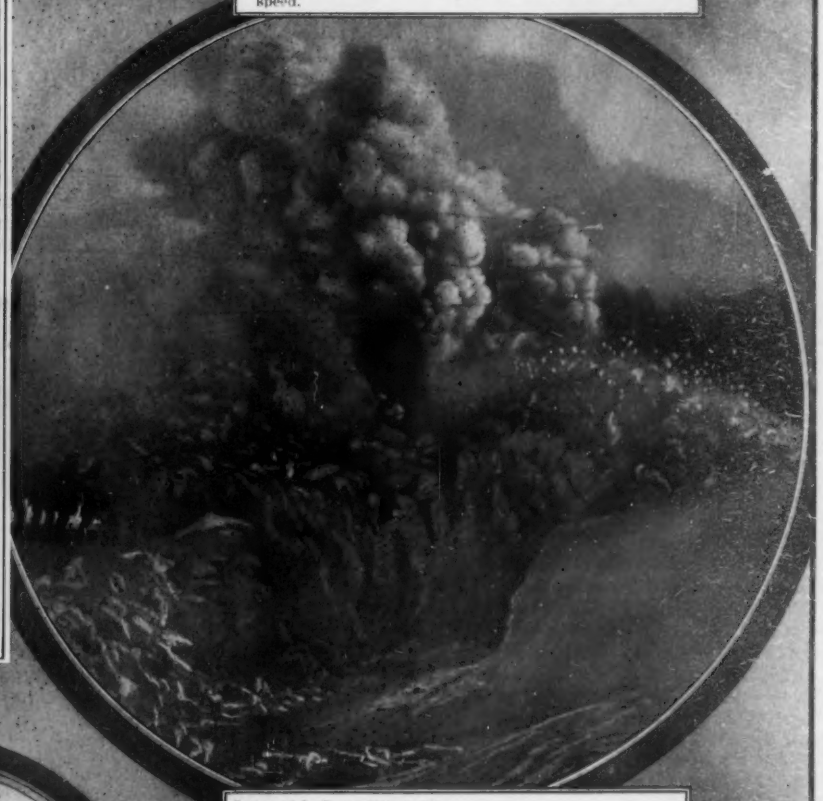
A "boxing glove" side car.

In order to advertise his wares a dealer in sporting goods, in France, has had a motorcycle equipped with a side car built to resemble an enormous boxing glove. Quite apart from its advertising qualities, a side car padded like this, should give the passenger a feeling of security when skimming along the road at perilous speed.



Piedro Miguel locks at night.

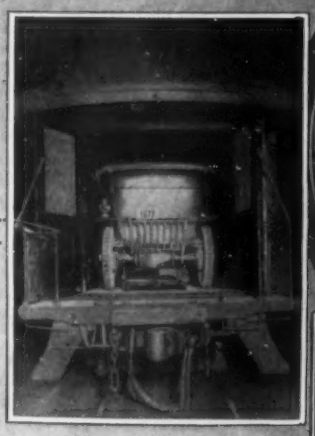
The locks of Panama will be illuminated with 400-watt tungsten lamps on concrete standards formed with concrete hoods to throw the light on the coping of the lock and the water chamber, while screening the axis of the canal, so that the pilots of vessels entering the locks will be shielded from their glare.



Courtesy of the *Illustrated London News.*

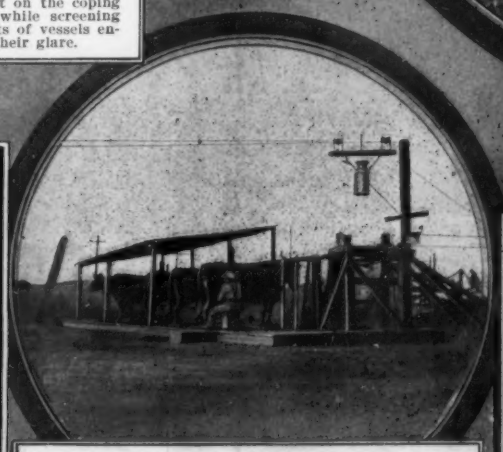
Snow plows at work in "sunny" France.

Some very severe weather was experienced in France this winter, not only in the North, but also in the South, which is noted for its mild, sunny climate. The photograph depicts a very unusual scene for that region: Two locomotives with snow plows clearing the railroad at Puichéric, near Carcassonne.



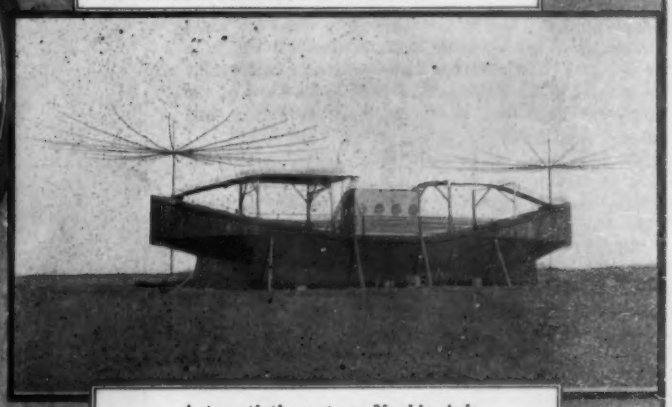
A parlor car garage.

In order that he may use his motor car at any point along the line, Mr. Louis W. Hill, son of Mr. J. J. Hill, and chairman of the Board of Directors of the Great Northern Railway, has had a garage constructed in one end of his private car.



The ingenious milkman.

A dairyman in Los Angeles found it burdensome to carry the heavy cans from the milking yard to the dairy, so he rigged up the trolley system shown in the photograph, which was inexpensive and easily built. The full cans are carried on a heavy wire by a small two-wheel car, and go all the way by gravity.



A twentieth century Noah's Ark.

Anticipating a second great flood a modern Noah is building an ark near Palo Alto, California. It is to be a catamaran, which the builder plans to drive by means of four wind wheels connected to propellers. The photograph shows one of the floats. It measures 50 by 17 feet and will draw six feet of water.

ODDS AND ENDS FROM THE EDITOR'S DRAWER

New Automobile Headlight

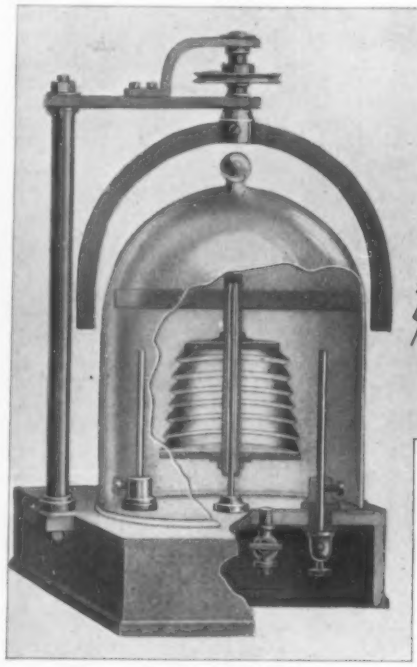
A HEADLIGHT which differs radically from all other automobile headlights, and involves a number of exceedingly interesting new features of construction and manufacture, has been invented by Edouard Cannevel, whose "Eyeball" headlight and ingenious carbureter have already appeared in this country and have been adopted by several manufacturers of automobiles.

The new headlight embodies a peculiarly shaped reflector, which is claimed to give remarkable results with an ordinary six-candle-power lamp on an automobile. Tests with the new reflector have shown its power to be greater than that of any other reflector at present manufactured.

As will be seen from the accompanying illustrations, the reflecting device consists of a series of annular, parabolic sections in combination with a curved mirror. Light rays are thrown from the lamp sideways toward the parabolic rings and by them reflected into the mirror behind the lamp. They increase those light rays sent directly from the lamp into the mirror and into the roadway ahead. In this manner the large amount of light "lost" through uncontrolled reflection from the side walls of the headlight is utilized for roadway illumination.

In order to be able to manufacture a silvered reflector of the kind used in this headlight, the inventor had to design a special apparatus, which is shown in another illustration. It consists of an air-tight bell, from which the atmosphere is exhausted and in which a small quantity of hydrogen is liberated. Mounted upon a pivot in the center of this bell is the reflector, carrying at its upper end a magnetized bar. The reflector revolves easily between two electric poles. Revolvably suspended above the bell is a huge magnet which by its drag causes the magnetized bar inside the bell, and with it the reflector, to revolve upon its pivot. The silver to be deposited upon the reflector is volatilized by an electric current of 60,000 volts at the poles and deposited upon the glass of the reflector.

In order to protect the silver from the atmosphere and its oxidizing influence, a special protecting surface of copper is subsequently deposited upon it by means of a metal spraying process.



Apparatus with which the new reflector is silvered.

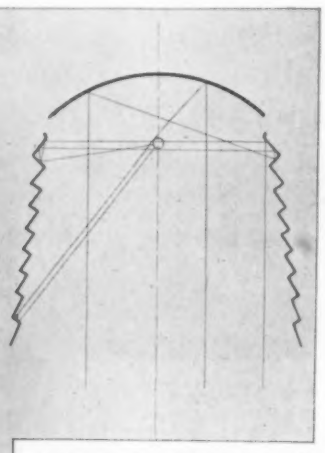


Diagram illustrating the paths of rays in ringed reflector.

The Marvels of Ultra-violet Radiation

By Richard Arapu

THE English novelist, Wells, in his "War of the Worlds," describes the invasion of the earth by armless, legless, tentacled, and megalocephalic Martians, who destroy men, houses, forests, and fields by directing upon them fluorescent green rays, that ignite and consume everything that they touch.

Radiations as remarkable and almost as destructive as these imaginary Martian rays have been studied in physical laboratories in recent years. These are the ultra-violet rays, which exist in sunlight, and which are produced abundantly by the quartz mercury vapor lamp.

Prof. Daniel Berthelot of the *Ecole Supérieure de Pharmacié*, who has made a profound study of these rays, said recently to the writer:

"The ultra-violet rays are the most rapid ethereal radiations that we are able to produce. This quartz lamp emits rays that vibrate 750 trillion times in a second. This prodigious number exceeds our powers of comprehension. Our eyes are blind to these too rapid vibrations as our ears are deaf to sounds too high in pitch. Yet, these invisible rays, which are detected by the photographic plate and perhaps by the eye of the ant, exert disastrous action on higher organisms, and especially on man."

The skin exposed to ultra-violet radiation reddens, inflames and peels. These are the effects of sunburn, and sunburn is explained by the abundance of ultra-violet radiations in the sun's rays.

"But the eyesight is most greatly menaced by exposure to ultra-violet rays, which in a few seconds produce painful conjunctivitis and ophthalmia. An exposure of three or four minutes may cause total blindness."

This peculiar property of ultra-violet rays may be utilized in future wars. In the recent war in Thrace many nocturnal attacks were made by Bulgarian troops armed with acetylene torches, the dazzling light of which blinded the enemy and made defense impossible. The invisible ultra-violet rays can be filtered from the green light of the mercury vapor lamp by a screen of suitable material and color, and it would be easy to devise apparatus which would emit a flood of these invisible destructive rays that would actually blind the enemy.

But these rays have other wonderful properties that suggest more peaceful applications.

"The ultra-violet rays," Prof. Berthelot continued, "make foodstuffs out of the gases of the atmosphere. Under the influence of these rays carbon dioxide and water vapor combine to form sugar and other carbohydrates. Hence, it is not too rash to look forward to the synthesis of certain foodstuffs. Theoretically, we may foresee the replacement of some of our fields of grain and sugar beets by factories in which food will be produced from the atmosphere by the agency of ultra-violet rays. The engineer, the physicist and the chemist will then take the place of the farmer.

"At present a kilogramme of sugar could not be produced in this way for sixty or seventy centimes. It would cost several thousand francs. But it cost Sainte-Claire Deville, the discoverer of aluminium, several hundred francs to produce a kilogramme of the metal, while pure aluminium is now worth less than two francs per kilogramme.

"Science moves so quickly nowadays that the partial realization of the synthesis of foodstuffs is perhaps less distant than some persons think.

"The ultra-violet rays have also made entrance into the realm of the ferments, those mysterious leavens on which some of the oldest and most important of human industries are based. I have inclosed foodstuffs—sugar, butter, and fats—in sealed vessels of quartz, and have effected their digestion by the action of ultra-violet rays, without the aid of any ferment.

"It seems to me that I have here touched one of the mysterious secrets of life. Food is digested by the action of the saliva, the gastric and intestinal juices, etc., which contain ferments or diastases that decompose the foodstuffs into substances that the body can assimilate. I have digested artificially by the agency of ultra-violet rays, foodstuffs of the three great classes, carbohydrates, fats and albuminoids, inclosed in globes of quartz.

"Perhaps the therapy of the future will make use of internal light baths, and dyspepsia will be treated by introducing into the stomach, instead of capsules of pepsin, tiny lamps that emit ultra-violet rays."

Prof. Berthelot examining a mercury vapor lamp with uranium glass spectroscope, devised by Soret and Cornu for making ultra-violet rays visible.

Prof. Berthelot holding a Billon-Daguerre mercury vapor lamp with double walls, designed for the sterilization of water.

Protective Coatings for Objects Made of Plaster of Paris

PLASTER of Paris reproductions of famous statues can be effectively used for the adornment of pleasure grounds, porches, pergolas, etc. Unfortunately, however, they are very susceptible to the ravages of the weather. *Recettes de la Maison* (*Household Receipts*) recently published formulas for protective dressings for such objects, without, however, discriminating as to their comparative value. Whereupon a contributor to *La Nature* (Paris) undertook to make thorough tests upon this point, the results of which have just been printed. For this purpose squares of plaster, mixed and moided in the ordinary manner, were covered with various coatings and then exposed to all sorts of inclement weather. The first was treated with boiled linseed oil, the plaster being saturated by successive application of 8 or 10 layers. Under this treatment it acquired a pale brownish yellow color, and was hardened almost as much as if it had been subjected to a borax bath. A genuine but not very durable protection was afforded by this treatment, since the plaster subsequently corroded, though very slowly.

The second treatment was of wax, applied by passing a hot iron over the scrapings of wax with which the surface had been dredged. Very little of the wax is absorbed unless the plaster had been previously heated. A beautiful yellow color, slowly growing paler, was obtained and the subsequent exposure left the plaster absolutely unaltered. The third application was of paraffine, which can be applied in two ways. First in the melted state, spread by hot iron, and secondly dissolved in carbon disulphide. This solution better penetrates the thickness of the plaster. In each case the plaster becomes a pale gray in color and the hardness is not modified. Both methods afford very efficient protection. The fourth material used was stearine, scrapings of candle-ends being spread over the surface by a hot iron. The result was a crystalline coating changing the white to pale gray. The protection furnished was excellent.

Finally, a 10 per cent solution of gelatine was used. The plaster absorbs little, because gelatification occurs soon after deposition. Parts of the surface were subsequently coated respectively with alum, bichromate of potash, and formol. In no case was this treatment successful, since the gelatine layer always dissolved or scaled away.

The conclusion drawn, therefore, is that wax, stearine, and paraffine are the best preservatives, and since the last is the cheapest it is probably best for most cases. It may be applied either by heating the surface or dipping the object in a hot bath of the melted substance used.

A Memorial to Benjamin Franklin is to be erected in what is probably the most interesting old church in England, viz., St. Bartholomew the Great, in Smithfield. Franklin worked as a printer in this church, part of which was then devoted to secular uses.

Exploding Mines by Wireless Telegraphy

By Dr. Charles Forbes, Columbia University, New York

THE newspaper accounts that have appeared from time to time in regard to the explosion of submarine mines by means of radio-telegraphy might lead the ordinary reader to believe there is danger of exploding powder magazines on war vessels, and torpedoes and mines located in harbors for defense, in the daily use of the wireless telegraph. Such an event cannot, however, take place without the intervention of apparatus specially constructed for the purpose.

An interesting laboratory experiment illustrative of the subject may be performed as follows: There must be apparatus for generating the electric waves, known as the Hertzian, from their discoverer; also apparatus for receiving the impressions produced by them. Like the telegraph and telephone the transmitting and the receiving instruments are essential. For the laboratory experiment the transmitting apparatus may consist of the usual amateur outfit. In the absence of this the sparks from an influence electrical machine, the induction coil or the Leyden jar will be sufficient to set up the Hertzian waves. In the simplest form the Leyden jar answers the purpose very well. The receiving apparatus consists of the Branly coherer, which is placed in series with a suitable electric battery, two dry cells being sufficient, and a relay, which in action closes a second electric circuit generated by another battery of two dry cells. This current is conducted by communicating wires to the exploding fuse in the mine to be exploded.

Inspection of the illustration will show the wiring and the arrangement of the apparatus for the laboratory experiment. Fig. 1 represents the Leyden jar being discharged by the discharging rods. Electric waves are represented passing outward in all directions ready to impinge upon receiving apparatus situated in their path. Fig. 2 represents the receiving apparatus. The coherer is at *A*, the battery at *B*, the relay at *C*, the relay battery at *D*, and the mine to be exploded at *E*, resting in a tank of water.

On discharging the Leyden jar, this is what takes place: The electric waves thereby generated pass onward through space, and acting on the coherer, its battery is set in operation, thereby closing the relay circuit, which in turn actuates the fuse, when the explosion of the mine is effected.

The essential part of the receiving apparatus is the coherer. The details of its construction are represented in Fig. 3. A glass tube about 2 inches in length is represented at *F*. Into this there are fitted rather snugly, brass or copper rods *G;* the internal ends being separated about one eighth of an inch and the external ends having metal disks attached, somewhat larger than those represented in Fig. 2. The space between the internal ends of the rods is to be nearly filled with filings of nickel about 9 parts and silver 1 part. If the pure metals are not available for the filings nickel and silver coins may be substituted. A trace of mercury, which is desirable, may be secured by amalgamating the internal ends of the rods in the glass tube. The coherer has this peculiar property; the filings, in the inactive condition, offer a high resistance to the passage of a battery current of electricity; when acted upon by the electric waves they are said to cohere, offering much less resistance, thereby allowing a much greater electric current to pass. This is sufficient to actuate the relay.

The miniature mine to be exploded is represented in Fig. 4, about the actual size. It consists of a metal tube with a rubber stopper inserted at its upper end and another at the lower end. Through the lower stopper the insulated conducting wires from the relay battery pass. The terminals are connected by a fine iron or platinum wire, which is imbedded in the gun powder in the inclosed chamber. The fine wire on becoming incandescent ignites the powder and the explosion takes place. Interest will be added to the experiment if, preceding the explosion of the miniature mine, the closure of the relay current be made to ring an electric door bell, and if by tapping the coherer, the ringing may be discontinued. In a similar manner electric lights may be lighted on substituting the electric light current for the relay battery current. In actual practice the sending apparatus of the wireless telegraph would be used to set the ether waves in motion and the submarine mine would be attached directly or indirectly to the receiving apparatus. From the above described experiment, it is quite evident that the accidental explosion of mines and other magazines of explosives by means of the Hertzian waves is very improbable. An explosion by electrical induction would be a very different thing, and could only take place at a distance of a few feet. For its occurrence, specially arranged apparatus would also be necessary.

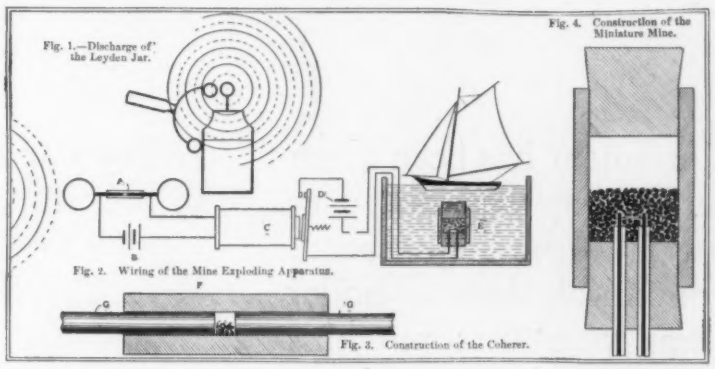


Fig. 1.—Discharge of the Leyden Jar.
Fig. 4. Construction of the Miniature Mine.
Fig. 2. Wiring of the Mine Exploding Apparatus.
Fig. 3. Construction of the Coherer.

Experimental apparatus used to illustrate the exploding of a submarine mine by wireless telegraphy.

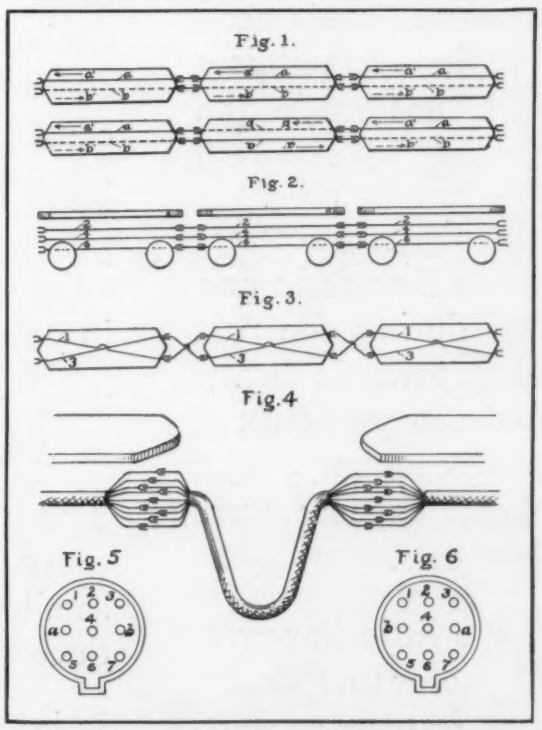
A New Experiment to Determine the Earth's Rigidity

A NEW and improved method for determining the rigidity of the earth has recently been devised by Prof. A. A. Michelson, director of the Ryerson Physical Laboratory of the University of Chicago.

The method consists essentially in measuring with great accuracy the tides in two steel tubes half filled with water. The tubes used in this experiment are of steel, each 500 feet in length, lying horizontally upon solid concrete foundations in trenches six feet deep, and are carefully insulated against temperature changes and other outside disturbances. They are placed at right angles to each other, the one in a north-south direction and the other in an east and west line. The water in the tubes communicates with chambers at the ends, where, by an ingenious arrangement, the change in level, i. e., the deviation from the true level due to tidal action, can be measured to a ten thousandth of an inch.

The object of thus producing tides in a closed tube is to eliminate as far as possible the unknown factors that play a part in natural tides, such as contours of coast-line, wind, ocean-currents, meteorological conditions, etc. The tide in these tubes is the resultant of two main factors; the deformation of the earth due to the attraction of the moon and the tractive force exerted by the moon on the water directly. This latter force can be calculated mathematically, and by subtracting this calculated amount from the tide actually observed the component due to the earth's distortion is found. Knowing the force exerted by the moon on the earth, and the amount of deformation produced by this force, the rigidity of the earth can be calculated.

The actual computations are far from simple, however, as the forces exerted by all the larger planets must be considered and various complicated correction factors must be introduced.



How the signal wires for controlling the motors of multiple-unit trains are arranged.

Arrangement of Wires in Multiple-unit Trains

By Samuel W. Balch

THERE are a number of pretty geometrical problems in the arrangement of the train signal wires which run through the multiple-unit trains for controlling the operation of the electric motors on the different cars. In order to understand the arrangement, it will be sufficient to assume that the motors and their controllers have seven speed arrangements, each of which can be brought about by turning current into the corresponding speed-signal wire, and the motor arrangements will be made the same on all the cars. In addition there are two direction positions which require two additional wires.

In the multiple-unit system these positions are selected by nine signal wires running through each car and coupled together where the car platforms meet. They are connected on each car to magnets, which need not be described here, so that if one of the speed wires and one of the reverser wires have current turned into them the same driving conditions will be set up on all the cars. A peculiar difficulty arises first from the fact that the direction in which a car will run with a given position of its reverser is a direction with respect to the car itself and not with respect to the points of the compass. Thus, if a car were taken from the main track on a Y switch and returned on the other branch of the Y, it would be turned around and the position of the reverser, which originally stood for north movement, would now stand for south movement. To prevent a car which has thus become turned end for end in a train from being at cross purposes with the other cars, the signal wires have simply to be run through the train parallel and in the same horizontal plane.

In Fig. 1 two trains are shown with the reversing signaling wires. In the second train the middle car is turned end for end. Turning current into signal wires *a a* sets the reversers on all the cars to run in the directions shown by the arrows *a' a'*, and turning into the signal wires *b b* sets the reversers oppositely. When the middle car is turned end for end and the wire *a* is given current at the head car, the wire *b* receives the current on the middle car and returns it to wire *a* on the rear car. Simple as this arrangement is, several of the first inventors of train lines do not show it in their patents.

The speed controlling wires require to be connected, wire 1 to wire 1, wire 2 to wire 2, and so forth, no matter how the cars are brought together into a train in whatever end to end relation or order. There are two ways of insuring this. One way is to put them on different levels and in the same vertical plane as shown in Fig. 2. Another is to leave them on the same level as in the case of the reverser wires, but the train wires must be crossed as shown in Fig. 3. The connections however must be crossed back again in the jumpers between cars. If only the wires through the cars were crossed, connections would still be kept right in case a car should be turned end for end, but wires 1 and 3 would be in exchanged positions in the odd positioned cars of the train as compared with the even positioned cars of the train, and a car wired for position 1, 3 or 5 could not be used in position 2, 4 or 6. The difficulty is overcome by the crossings in the jumpers. These are in effect extra sections of the train line so that the train line sections on the cars are only the odd numbered sections. The detachable sections between cars are necessary in the form of the flexible jumpers as shown in Fig. 4 to conform to the flexibility of the train. Each set of terminals is brought together in a head so that the coupling of all can be performed at one operation, and the three systems described are combined to secure a compact arrangement of the nine terminals. This arrangement at one end of a car or jumper is as in Fig. 5, and at the other end as in Fig. 6.

As in practice there is no room for the coupling at the center line of the train, the couplings are repeated on both sides, either of which is coupled according to convenience. The wires, however, can have the same arrangement as for the center line, and this plan is followed in all multiple-unit installations.

Where two train lines thus become necessary, a simpler solution is possible, in which all the wires are run parallel in each train line, but in right and left arrangement in the two lines. This was the case in the first multiple-unit installations by Frank J. Sprague, but it was not known to the engineers who developed the system at present in use. Other ways of doing this are shown in patents No. 405,897, June 25th, 1889, Harry W. Leonard; No. 660,065, October 16th, 1900, Frank J. Sprague.

Who Will Imitate J

Wide public endorsement has been given to the idea which Jeffery brought over from Europe last fall—the high speed, light weight, economical, four cylinder motor. He it was who first put this dominant idea into American practice—produced the first light weight economical, high grade Four to sell at $1550.

There are persistent reports that other makers will pay tribute to Jeffery by producing cars of a similar type—next year. Imitation is, indeed, the most sincere flattery and we welcome this imitation with hearty good will.

The unmistakable demand for light weight and economy has become so pronounced that engineers do not hesitate to publicly endorse the idea which has made the Jeffery a big success.

It is well known that the biggest successes of the industry have been founded upon cars of this type. Yet, during the past two years, the tendency towards heavy weight in design became so pronounced that people who valued economy, light weight and low upkeep expense were forced to buy low priced cars.

For two years there was little improvement in the design of motor cars except in body details and such features as starting devices. Then a great wave of economy spread over the country. People were forced to take inferior quality, scant comfort and sacrifice appearance to realize economy.

Jeffery saw that the industry was traveling in the wrong direction. He sent his engineers to Europe, where the best makers have already had the same experience which most American makers must yet go through. The high speed motor is dominant over there—it has made good. Jeffery brought that idea to America. Then he built the Jeffery Four at $1550 and the Jeffery Six at $2250. Power he attained through speed instead of bulk.

In five months orders have been taken for seven thousand Jeffery cars.

Now the light, economical car has won the victory. The big sale of Jeffery cars is evidence enough of that. Our shipments during the first three months of the year exceeded those of last year by 103 per cent.

Read the clipping from Motor Age opposite and you have concrete evidence of what will certainly be the dominant type in years to come.

The Jeffery Four represents that dominant type.

The leading trade papers are commenting every day upon the superiority of the small, high speed motor. Jeffery introduced that type into America last fall.

It is quite likely that other light Fours will be built, but we do not fear this competition because there is embodied in the Jeffery Four the best material that the market affords and the best ideas developed by the best mechanics in the world.

Jeffery Next Year?

The Thomas B. Jeffery Company — Jeffery — Kenosha, Wis. U.S.A.

Fortunately, Jeffery is in the best position to meet the keenest competition. He has no stockholders to satisfy. He is the one man in the United States who controls a complete automobile factory and every dollar's worth of equipment is paid for. He discounts all bills. Therefore, he is able to buy right. He is satisfied with a small profit. Therefore, he can build the best four cylinder car in America and sell it at a price which cannot be duplicated by manufacturers lacking his capital, equipment and experience.

Here are the specifications which gave Jeffery leadership in sales after he attained leadership in ideas.

SMALL HIGH SPEED MOTOR, introduced by Jeffery November, 1913.

IMPORTED ANNULAR BALL BEARINGS—endorsed by cars selling above $4,000—adopted by Jeffery.

RAYFIELD CARBURETOR—endorsed by dealers—adopted by Jeffery.

VANADIUM STEEL SPRINGS AND AXLES—endorsed by everybody—adopted by Jeffery.

FOUR SPEED TRANSMISSION—demanded by the public—adopted by Jeffery.

MOST EXPENSIVE FULL FLOATING REAR AXLE—most costly—most quiet starting and lighting system—most expensive body in design and finish—Spicer universals—the last word with mechanics—pressure feed gasoline tank—Neverleek top—oiling system best known—Bosch Duplex ignition—left steer and center control—cone clutch—wheel base 116 inches—demountable rims—equipment—top made of best material, top cover, rain vision windshield, robe rail and foot rest—Klaxet horn, Solar electric lamps, power tire pump and complete tool equipment.

Electric lighted auxiliary dash, on which is mounted Warner autometer, ammeter, gasoline and oil pressure gauges, light switch, coil switch, electric horn button and two compartments for valuables. The one electric light switch has four positions to operate—the side, head, dash and tail lights. Switch can be locked in any position. Tail light and dash light work on relay.

THE WISE BUYER WILL GET A JEFFERY FOUR now because next year his car will still embody all the leading construction principles. It is made from the best materials that can be put into any car at any price. Find the nearest Jeffery dealer today.

26 MOTOR AGE March 12, 1914

Small High-Speed Motors Pronounced a Success in Europe

English Engineer Describes Design of Efficient Engines Before Detroit S. A. E.

By D. McCall White

EDITOR'S NOTE—Americans are just beginning to wake up to the possibilities of small motors designed to run at high speed. It may be expected that this interest will be increased before the year is out by the appearance of some of these very small motors to represent Europe in racing events. Indianapolis will see at least one of these Memorial day. Few men are more qualified to discuss the high-speed motor than D. McCall White, former works manager of the Crossley Motors, Ltd., Manchester, England, and late chief engineer for D. Napier & Son, Ltd., London, England, who is now employed with the Cadillac Motor Car Co. He addressed the Detroit section of the Society of Automobile Engineers on this subject last week and his remarks are reproduced herewith.

I HAVE been asked to say a few words regarding the development of the high-speed engine in Great Britain. We have been producing, in some of our factories on the other side, high-speed engines for the last 4 or 5 years which will run successfully in touring cars without any more trouble than the ordinary slow-speed engines. In fact, 3 years ago the company I was connected with was in a position to give a 3 years' guarantee with its cars, the engines of which ran at a maximum speed of about 2,300 to 2,600 revolutions per minute.

Make Good in Territories

Within the last 2 or 3 years we have been producing engines which have been running maximum power at 2,400 revolutions per minute, and these have on the slightest down grade accelerated to 2,800 revolutions per minute. These particular cars have been successful not only in the British Isles, but have been highly satisfactory and successful in our colonies, such as, for example, Australia, New Zealand, etc., where the roads are, I think, pretty much on a par with American roads. In fact, I have, just before leaving England, inspected a report from one of my assistants who was out in Australia inspecting and generally looking into the matter, and his report, as well as the agent's report on the behavior of cars out there, not only of our own production but those produced by other firms which were also of the high-speed class, was entirely satisfactory.

Another firm, with whom I have not been connected, has been most successful in the colonies, not only in competitions such as hill climbing, but in competitions of great hardships over large tracts of land such as you are accustomed to in this country. I am particularly aware of the points in connection with this particular firm, as the engineer is a very great personal friend of my own.

I am stating these points because, in discussing them with some of your engineers, I have found that quite an erroneous idea seems to exist regarding the durability of the high-speed engine, fitted into a moderately light chassis. In the first place, the chassis which these engines are called upon to pull, are not very light chassis, being in most cases just about the same weight as some of your most modern chassis. These chassis are designed to stand up, and they do stand up, not only in Britain but also in the colonies. A horsepower represents 33,000 foot pounds of work whether it be developed in Britain or in America, and if this horsepower can be obtained with a smaller engine, then greater economy will be the result.

Gasoline may be cheaper here than it is in Britain, but I have yet to see the man who refuses to accept the same result as he previously obtained by paying less money for it. As examples of what has been done, I have designed a four-cylinder engine 2¼ inch bore by 5 inch stroke, which developed 36 brake horsepower at 2,600 r. p. m., fitting it to a chassis with a wheelbase of 100 inches, the weight being 1,680 pounds. This car was beautiful to handle and it was a marvel to see what it could do on the top gear with a load. It could pull on top gear at 10 miles an hour, on a very decent gradient, in practically the same manner as a six-cylinder engine, 3¼ by 5. The wheelbase of the six was 126 inches and the chassis weighs, as far as I can recollect, about 2,632 lbs., both chassis carrying a load of driver and one passenger, plus the weight of 896 lbs.

Most Efficient Valve

easily appreciated, when I sta... 15 to 25 per cent more th... the cylinders for a ... with this arrangement ... rangement as presented ... of motor.

I have been ... many of your ... favor the T h... arrangement ... to be the ... order ... neces... two ... the ... this ... also ... two ... fer... ma... I k... horse... are ... pra... per... an ... obtai... sizes ... upi... tip... run ... p. m., ... is so larg... the siz... be out ... Some... was ... firm. ... Valv... Re... val... in...

ll car...

The Thomas B. Jeffery Company

Main Office and Works, Kenosha, Wisconsin

RECENTLY PATENTED INVENTIONS

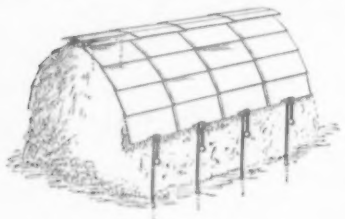
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

HAT BRIM PRESS.—F. HERR, 68 Wooster St., New York, N. Y. This invention provides means for stretching the brim while in the press and under control; and provides power means manually operable for exerting an extra pressure upon the material forming the brim, said means being controllable to conform to the inherent conditions of various materials.

Of Interest to Farmers.

HAYSTACK COVER.—F. A. FREELAND, Athelstan, Iowa. This invention has special reference to novel and useful improvements in covers for haystacks. The primary object of the invention resides in the provision of an improved cover which will automatically adjust



HAYSTACK COVER.

itself to a stack as the latter settles, whereby the stack will not only be protected, but the cover will be prevented from blowing loose in case of high winds. The accompanying illustration is a perspective view of the improved self-adjusting haystack cover applied to a stack.

SWEEP RAKE.—W. H. SELLERS, JR., Florence, Kan. The purpose of the invention is to provide the teeth of the sweep rake with means whereby the hay may be sufficiently compressed and packed on the stacker as to prevent it from falling away with the sweep rake when the latter is withdrawn.

COTTON PRESS.—J. H. BODDIE, 802 S. 6th St., Muskogee, Okla. An object here is to provide a dog locking and releasing means for the revolving press boxes whereby the cotton after compression by the tramper is held during the revolving of the box from its receiving position under the tramper to its transfer position under the ram and under the compressing and baling box. At this point the dogs are automatically released so as to allow the ram to raise the partially compressed cotton in the compressing and baling box.

AUTOMATIC HAY-EJECTOR FOR SWEEP RAKES.—B. F. LEWIS and J. W. LEWIS, Hartland, Kan. Address E. R. Shorpe, Larkin, Kan. The present invention is an improvement on the patent granted to these inventors, No. 1,038,165. In the latter the hay-ejector or hay-pusher is required to be adjusted manually by the driver of the rake in order to throw it into and out of action, whereas in the present, the action is entirely automatic, thus effecting a considerable saving in time and expense.

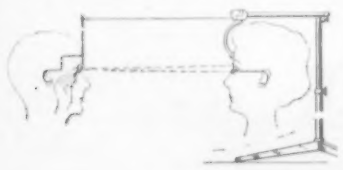
ROPE TAKE-UP.—J. C. WILLIAMSON, Cordele, Ga. This device is for use in stump pullers and like machines, wherein a take-up or tie is provided for connecting the stump to the pull rope, so arranged that after the stump has been pulled, the take-up or tie may be released from the pull rope, and removed to another stump, and without interfering with the operation of the pull rope as it pulls the succeeding stump.

WEED PULLER.—D. GOTTFRIED, Quindan Station, Kansas City, Kan. This device is capable of being held in the hand, and has means for grasping and holding the weeds so arranged that the weeds may be grasped lengthwise of the stalk and beneath the surface of the ground if desired.

STEERING DEVICE FOR CULTIVATORS.—A. T. HOLMES, St. John, Wash. The more particular purpose of the invention is to enable the operator to cause the cultivator to make a comparatively short turn, thus occupying a minimum of room for the purpose and also enabling the turning movement to be easily executed.

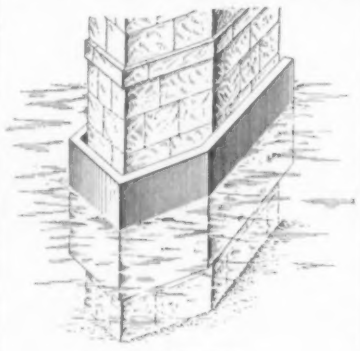
Of General Interest.

OPTICAL INSTRUMENT.—W. WORK, care of Herman S. Hewett, 119 Main St., Brockton, Mass. This instrument is for use in conjunction with a plano-retinoscope, arranged to permit of quickly and accurately determining the amount of refraction of the eye of a patient under observation by an oculist or other examiner, to insure fitting the patient with eyeglasses or spectacles having correct spherical, cylindrical or compound lenses. To accomplish the desired result use is made of an indicator and controlled by the examiner during the use of the plano-retinoscope.



OPTICAL INSTRUMENT.

PIER PROTECTOR.—S. C. MAY, 830 Tenth St., Modesto, Cal. Means in this invention provides protection for bridges, piers or the like from damage due to floating logs, ice or débris carried by currents of water. Among the objects, therefore, of this inventor is to provide a means of a simple and permanent nature adapted to be secured to or arranged in



PIER PROTECTOR.

association with a pier or the like projecting into or upwardly from a body of water, said device being so arranged with respect to the pier as to float upon the surface of the water whereby it will always be automatically maintained at proper elevation with respect to said surface.

SHAVING AND LATHER BRUSH.—D. I. HARTMANN, 137 Regent Place, Brooklyn, N. Y. This invention includes a handle, a set of bristles and a massager carried by the handle and located within the mass of bristles, the arrangement being such that the bristles may be used as usual for the application of soap to the beard and then for the massager to be brought into use by a slightly greater pressure upon the handle for the purpose of forming the lather directly upon the face without the operation of the fingers.

BEARING.—C. G. LUNDGREN, 210 Adams St., Chicago, Ill. The purpose here is to provide a bearing which may be used on grinding wheel heads, and to provide solid tapering bearing members, which are adjustably secured to the heads, so that they may be moved longitudinally when slightly worn, to fit snugly the tapering portion of the spindle carrying the grinding wheel.

LOOSE LEAF BINDER.—W. C. TRAHER, London, Ontario, Canada. The covers are manufactured rapidly and complete before the locking hooks are secured in place. They may be passed through rollers in the last stages of manufacture, which could not be done if the hooks were secured to the covers before the latter were completed. Plates for the hooks are corrugated, which permits of the use of very cheap metal, wires being provided, the central portions of which are clamped by the plates with wire terminals bent to form hooks. Each corrugated plate has bent spring flanges, which engage the companion plates for holding the plates in position when their outer edges are slid within the flanges of the spring plate which is secured to the covers after their completion.

COMBINATION REINFORCING ROD AND WALL PLUG.—J. MCLOUGHLIN, Glen Cove, N. Y. This invention relates to devices used for supporting the molding board or planking of any kind on a brick or concrete wall; and has reference more particularly to a device comprising wooden wedges at a predetermined distance from one another, having an edge flush with the wall incorporating the same.

CABLE GUIDE.—H. HOLMES, Noyo, Cal. In the present patent the invention has for its object the provision of a cable guide inexpensive to manufacture and one having a free movement for use in directing the cable as may be desired and under all conditions of operation.

LUMBER JACK.—C. E. EVANS, Weed, Cal. The jack has a yoke with a stud journaled in a supporting arm, and studs carry a member having teeth for engaging the lumber. The teeth are inclined to adjust the yoke relatively to the supporting arm to hold the yoke so that the teeth will be inclined as desired relatively to the supporting arm. Pins extend from the teeth member to limit the latter's movement. A collar is held in adjusted position relatively to the stud by a cotter pin, this collar being provided with a flange for engaging the supporting arm to check the rotary movement of the yoke relatively thereto.

HORSE OVERSHOE.—C. E. DEUSCHER, 223 St. Ann's Ave., Bronx, N. Y., N. Y. This device is adapted to be easily attached to or removed from the hoof, and is provided with gripping devices of peculiar construction adapting them in a superior degree to the making of a sure hold upon the ice, and may be readily replaced if worn out or broken.

MUSIC HOLDER.—E. J. BABBITT, Onaway, Mich. This holder comprises a base and a music supporting frame provided with means for engaging beneath the front board of a piano, the base and the frame slidably and frictionally connected to permit relative adjustment of the frame when the base is in engagement with a fixed support, and of the base when the frame is engaged with a piano.

GREASE CUP.—E. H. PRESBREY, 1777 Broadway, New York, N. Y. The improvement provides a base adapted to be secured adjacent a bearing, said base having a delivery tube, and means for quickly attaching thereto a cup filled with grease, special means being provided to prevent a loss of said cup from the base or any tendency for the parts to rattle when in use.

MOTOR.—B. STEWART and D. B. STEWART, Garden City, Kan. This water motor is adapted to be arranged in a flowing stream, and is provided with vanes for engagement by the water to rotate the wheel, so arranged that on one side of the wheel the said vanes will automatically take a position at approximately right angles to direction of the flow, and on the other side will automatically take a position approximately parallel with the direction of flow to offer the slightest possible amount of resistance to said flow.

DETACHABLE HORSESHOE CALK.—G. I. DE FORCE, Erie, Pa. This calk is one which is capable of quick attachment and detachment, which may be attached without loosening or removing the shoe, which will not engage the hoof of the horse nor incommode the horse in any way, which will fit any shape hoof, and which is so arranged that the greater the strain the more tightly the device grips the shoe.

Hardware and Tools.

KNIFE AND SCISSORS SHARPENER.—A. HELMER, 326 53rd St., Brooklyn, N. Y. This inventor provides a device designed to be adjusted so that either a knife or pair of scissors may be sharpened by an unskilled person. It provides a pair of abrading rollers and means for locking the same in adjusted position, together with means for guiding the blades of a pair of scissors against one of the rollers.

SAW JOINTER.—WILLIAM E. GIBBS, care of W. L. T. Co., Oak Point, Wash. The device of this patent provides a novel arrangement of adjustable members and gage elements designed to provide a simple construction permitting of a wide range of adjustments to adapt the tool to the various operations of jointing, filing, and swaging, and enable the same to be performed with facility and accuracy.

COMBINATION TOOL.—L. KALINA, 132 Nassau St., New York, N. Y. The inventor provides a combination tool embracing a key ring, scissors, button hook, cigar cutter, and bottle opener, and arranged to take up very little space when the several devices are in folded position, thus allowing of conveniently carrying the combination tool in a vest pocket.

TOOL.—J. E. W. BOESCH, care of Overbeck Bros., Columbus Ave. and 82nd St., New York, N. Y. The invention provides a tool having a pivotally mounted member on the end, and a reciprocating or removable hammer structure for locking the pivotally mounted portion of the tool in various adjusted positions so as to cause the same to act as a hammer, a wedge, tack puller, box opener, etc.

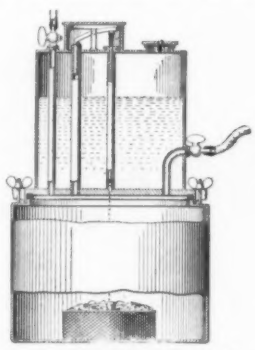
ASSEMBLING SOLDERING TOOL.—J. E. ERAUGH, 215½ W. Reed St., Moberley, Mo. This tool is especially adapted for holding two parts in assembled relation so as to be soldered or otherwise united, the tools being in the nature of pliers designed for use by jewelers, opticians and the like for conveniently holding broken parts together while being soldered.

Heating and Lighting.

SUPERHEATER.—E. J. AKINS, Moundsville, W. Va. The invention provides a device for utilizing the waste heat from a traction engine or similar machine, for superheating the exhaust steam and again utilizing the same in any desired manner, as for instance in a low-pressure cylinder.

SECTIONAL STEERING WHEEL.—L. E. LAURANCE, Stites, Idaho. This invention is in sectional steering wheels, and like hollow bodies, and provides a hollow body consisting of separable sections and having partitions separating the interior of the hollow body into compartments, sundry of these having openings covered with transparent coverings, the hollow bodies being adapted to contain heating and illuminating devices for heating the hollow body and for illuminating objects near the said body.

ACETYLENE GAS GENERATOR.—K. W. HOLLINGSWORTH, Columbia, S. C. The carbid is first put in and the tank secured to a casing by bolts. Water is introduced into the tank through an opening, after which the screw cap is placed in position. As water flows through the openings it drops down upon the carbid and acetylene gas is generated. As the water flows into the casing, air is drawn through an opening to take the place of the water. As gas pressure rises it forces the piston upwardly, thereby causing a needle valve to shut off the flow of water through the medium of a lever. The gas is used by connecting the feeding device with a stop cock. By connecting to the stop cock part of the gas may be used for lighting purposes. Pressure decreasing sufficiently within a receptacle, a spring will open the needle valve to again permit water to have access to the carbid and the gas will begin



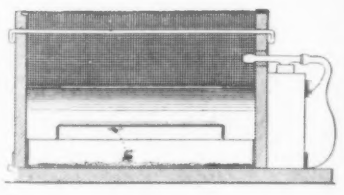
ACETYLENE GAS GENERATOR.

to generate again. Thus, action of the generator is automatic.

Household Utilities.

TOWEL HOLDER.—J. E. ADAMS, Box 127, Loveland, Ohio. This improvement relates to a towel roller, and particularly to a roller having a novel means for securing the same at one end to a suitable support, there being a novel arrangement of bearings for a core or center rod on which the roller revolves.

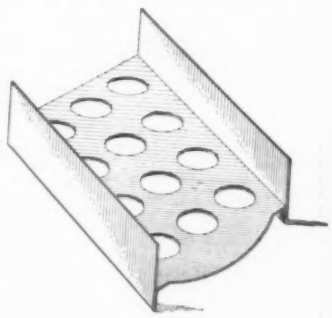
FLY TRAP.—C. H. CURTIS, Bluffton, Fla. In carrying out the invention a trap chamber is formed of woven wire or equivalent reticulated or openwork material, and is arranged above



FLY TRAP.

the bait chamber, provision being made for clamping the sides of the woven wire to the sides of the bait chamber. In connection with the trap a sprayer is provided, the nozzle of which is so arranged that a spray of insecticide to destroy the flies may be directed into the trap chamber.

EGG HOLDER.—C. S. WEBER, 10 Desbrosses St., New York, N. Y. This holder stores eggs in ice boxes, provision chests, in pantry shelves, and the like, and is arranged to safely hold a dozen or more eggs in a comparatively small

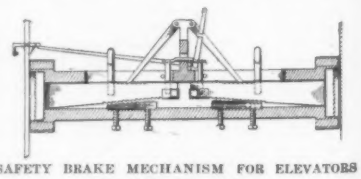


EGG HOLDER.

space, to allow of conveniently placing the holder with the eggs thereon into a household receptacle or onto a shelf and to protect the eggs against injury by other articles when placing the latter into an ice box or removing the same therefrom.

Machines and Mechanical Devices.

SAFETY BRAKE MECHANISM FOR ELEVATORS AND HOISTING CAGES.—J. CESERANI, 2217 Leatherwood St., Butte, Mont. In this invention the object is to provide a simple and inexpensive apparatus which may be actu-

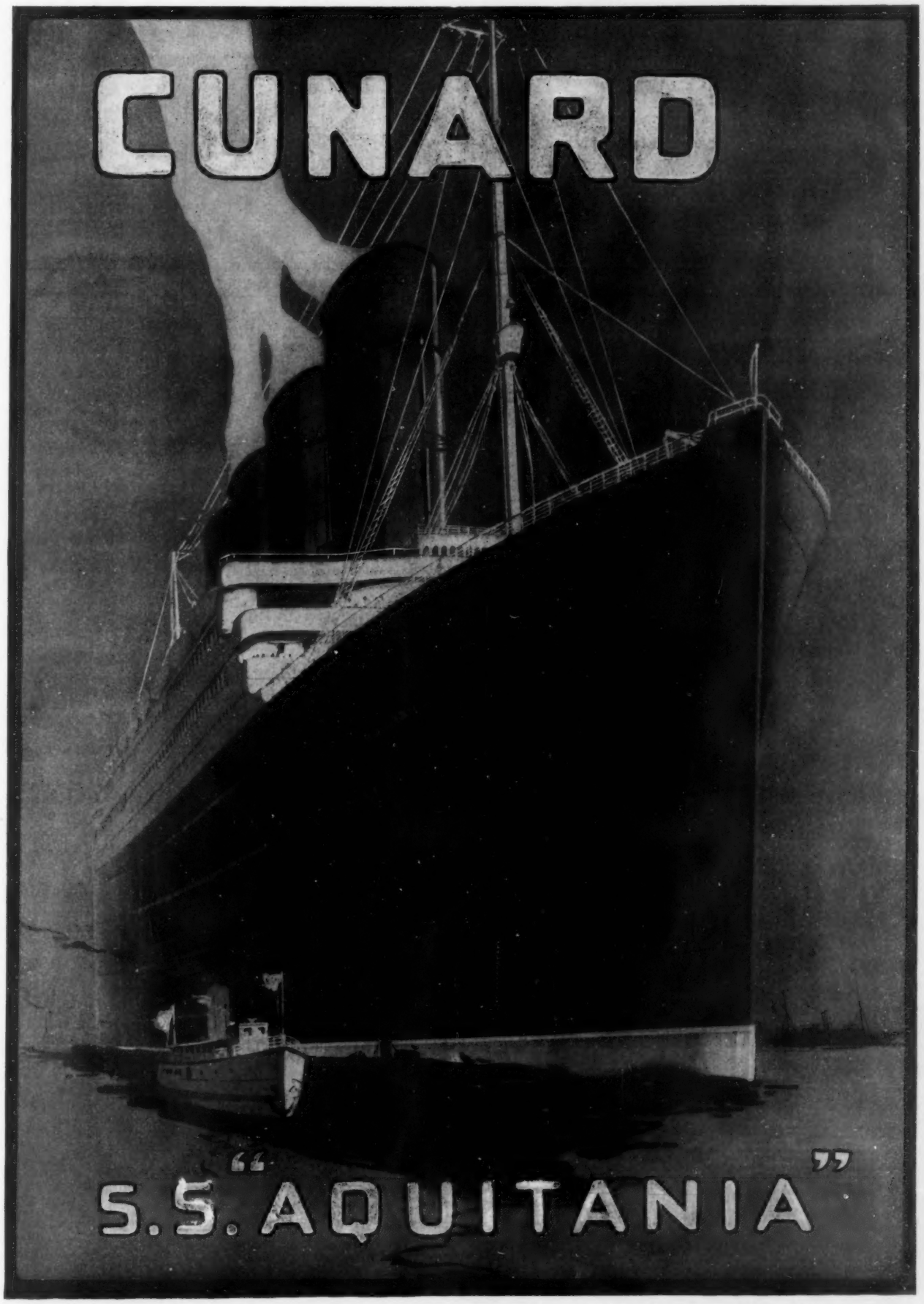


SAFETY BRAKE MECHANISM FOR ELEVATORS AND HOISTING CAGES.

ated by a passenger or other person on the cage, in case of an accident such as the breaking of a rope, engine running away, a wrecked shaft; and other causes, permitting the passenger or other occupant of the cage to quickly and effectively check the lock and cage against movement.

SUBMARINE MINE.—GIOVANNI E. ELIA, Rome, Italy. This invention relates to an ad-

(*Continued on page 590.*)



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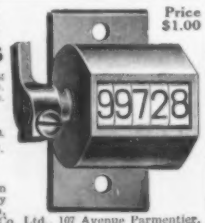

Notes for Inventors

A Novel Target.—In a patent No. 1,092,425 Frederick Bohn of Kiel, Germany, describes a target for marine aiming drill. The target simulates the movement of a rolling ship, being for such purpose given a movement, with alternate velocity, up and down and laterally.

Improved Refrigerating Apparatus.—Adolphe E. Bossé of Pittsburgh, Pa., has secured patent No. 1,092,426 for a refrigerating apparatus by which to prevent the improper operation of the apparatus and thus avoid accumulations of high pressure of the gas.

Typewriter Eraser Operated by a Key.—In patent No. 1,083,466 Harry I. Seddon of Portland, Ore., provides an erasing means for a typewriter in which an erasing head is yieldingly pivoted on a bar and the latter is connected to a key lever so that the key lever may be moved to operate the eraser.

French Artificial Wood.—Information has been made public in Lyons, France, concerning an artificial wood, which, it is stated, will be of great value as a substitute for natural wood. The new product has been found after years of study and practical experiments, the most recent of which have given eminently satisfactory results. The process consists in transforming straw into a solid material having the resistance of oak. The straw after being cut into small pieces is reduced to a paste by boiling, to which certain chemicals are added. When the paste has been reduced to a homogeneous mass it is put into presses, and planks, beams, laths, and moldings of all sizes are readily made. This new material can be sawed like natural wood. As a fuel, it emits a bright flame and little smoke. It is further stated to be adaptable to the manufacture of match stems.

An Automatic Gas Extinguisher.—Edwin H. Hawley of Washington, D. C., in patent No. 1,088,987 shows an automatic gas extinguisher in which a self-closing stopcock is released by a trigger arranged adjacent to a flexible diaphragm carried by an annual air chamber made of thin sheet metal and located above the burner, the trigger being adapted to release the self-closing stopcock.

A Dose-indicating Glass Cover.—Ithamar P. Berthrong of Washington, D. C., has secured patent No. 1,091,114 for a dose indicator. A glass cover has a central depression to receive a spoon bowl. An upstanding rim flange is notched to receive the spoon handle and is provided with dial fingers corresponding with the notches, so that the location of the spoon may indicate the time when the next dose should be taken.

An Illuminated Practice Target.—In patent No. 1,091,116 to William H. Buel of New Haven, assignor to Winchester Repeating Arms Company, is shown a target whose impacted surface is prepared with a flash-light composition ignited by the impact of a bullet so that a circumscribed area about the point of strike is illuminated, and can be seen by the marksman.

Sterilizing Liquid by Means of Ultra-Violet Rays.—Patent No. 1,091,221 to the R. U. V. Company, Inc., of New York, presents an apparatus for sterilizing liquid in which a vapor electric lamp is immersed in the liquid in a tank and an envelope permeable to ultra-violet rays surrounds the part of the lamp which emits ultra-violet rays, air being exhausted from the intermediate space.

Printing Signs on the Pavement.—William J. Ryan of Sapulpa, Okla., in patent No. 1,092,749 provides means for stamping a sign or advertisement on a street pavement rapidly and at successive intervals.

Helping the Eye to Follow a Golf Ball.—William Hiram Brown of Cleveland, Ohio, in patent No. 1,091,186 provides a device designed to aid in teaching a golf player how to make a stroke, it being based on the idea that a golf player shall "keep his eye on the ball."

A Novel Air Brake System.—Frank H. Dukesmith of Meadville, Pa., assignor to Thomas C. Vanhorne, Pittsburgh, Pa.,

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Inquiry No. 9365. Wanted the name and address of a manufacturer of machinery for embossing tin foil as is used in packing cigarettes.

Inquiry No. 9366. Wanted the name and address of a manufacturer of wire wheels, front axles complete with steering or separate, light sheet metal bodies, fuel tanks with cocks, pressed steel frames, mufflers, motors of the two cylinder opposed type, cushions and many smaller parts for cycle cars.

Inquiry No. 9367. Wanted the name and address of a manufacturer of an automatic centering machine.

Inquiry No. 9368. Wanted, the name and address of glass-bottle manufacturers or glass blowers who can manufacture a glass bottle and perforate it with some 12 small holes, in large quantities for export, to sell at a popular price.

Inquiry No. 9369. Wanted, the names and addresses of users of Indian Steatite (Soapstone), Corundum and other Indian minerals, in quantities.

Inquiry No. 9370. Wanted the names and addresses of manufacturers of small wooden articles, particularly in such soft woods as pine and fir, for articles such as toys, furniture, etc.

Inquiry No. 9371. Information wanted where one could buy or have made to order machine to be used for making solid back brushes.

Inquiry No. 9372. Wanted the name and address of manufacturers of a collapsible box about 12 inches square. It must be strongly made to withstand rough usage in transit.

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has secured patent No. 1,092,812 for an air brake system which provides for holding the engine brakes while releasing the train brakes so as to prevent pulling the train in two in releasing. The engine brake is also held while recharging the train auxiliary reservoirs, and the engine brakes are set without setting the train brakes.

Economical Firing of Locomotives.—George C. Weston of St. Louis, Mo., in patent No. 1,092,466 records the number of times the locomotive fire door is opened and aims thereby to induce the fireman to fire in a more economical manner by keeping the fire door closed as much as possible.

Safeguarding the Operator of Power Presses.—Milton E. Winans of Newark, N. J., assignor to Western Electric Company of New York city, in patent No. 1,092,667 guards against injury to the operator of a power press. When the treadle or supporting device is inadvertently held or depressed in abnormal position the machine cannot repeat its operation or stroke to the injury of the operator.

Folding the Gas Stove Into a Wall Recess.—Patent No. 1,092,681 to Raymond Stuart Way of Los Angeles, Cal., assignor of one half to Charles W. Pressley of same place, by a novel construction permits the folding of a gas stove out of the way into a recess in the wall when not in use.

Paper Feeding Apparatus.—In patent No. 1,092,437 Milford B. Ferguson of New York city, assignor to Package Machinery Company of Massachusetts, shows a paper feeding apparatus especially designed to feed single sheets from a stack in such manner as to overcome the liability of the apparatus to feed two or three sheets instead of one.

Increasing the Efficiency of Hydrocarbons.—A process which seeks to increase the heating efficiency, illuminating efficiency and explosive power of hydrocarbons, such as gasoline and naphtha, by the addition of specified materials of low cost is described in patent No. 1,092,461 to Arthur W. Swanberg of Minneapolis, Minn.

Encourages Railway Invention.—U. S. Consul Treadwell of Bristol, England, writes in an interesting way of an undertaking by the Great Western Railway to investigate and patent inventions which relate to mechanical contrivances likely to be useful on railways and suggested by any of the employees. This will doubtless operate as an encouragement to their force of men, but it does not in any way prevent such men from offering their inventions elsewhere. However, it provides for assistance to such men in case they do not find themselves in position to take out patents for railway inventions that may prove of great value. It is reported that other railway companies, appreciating the merits of the scheme, have similar projects under consideration.

A Series of Air Brake Patents.—Spencer G. Neal of Los Angeles, Cal., assignor to California Valve & Air Brake Company of the same place, has secured patents Nos. 1,089,574, 1,089,576, 1,089,577, 1,089,578 and 1,089,579 for improvements in compensating valves and patent No. 1,089,575 for an auxiliary pressure control valve, the several valves having the particular construction specifically described in the patents.

Inventors and Industrial Artists in Congress.—The Society of Inventors and Industrial Artists will hold its fourth international congress in Lyon, France, August 17th to 21st of this year. Among the matters which will be discussed at the congress are (1) International patents; (2) The exploitation of patents; (3) Proper means to encourage inventors; (4) Course and duration of patents; and (5) International deposit of designs and models.

Combining a Steam Boiler with the Oil Burner.—In patent No. 1,089,076 granted to Julius J. Plank of Kansas City, Mo., is shown a steam boiler with an auxiliary steam generator removably mounted in the firebox of the boiler and an oil burner which has a steam line to the boiler and connected with the auxiliary generator.

Trade-mark Notes

Hosiery and Knit Underwear Same Description of Goods.—In a recent decision Court of Appeals of the District of Columbia in the case of H. Wolf & Sons, appellants, v. Lord & Taylor, appellee, sustained the decision of the Commissioner of Patents supporting the opposition by Lord & Taylor to the registration by H. Wolf & Sons of the same mark for use on knitted and textile undershirts, drawers and union suits of the mark of Lord & Taylor registered for hosiery. In the decision the court said, "Would appellant's use of the mark on underwear lead the ordinary purchaser to believe that he was buying the goods of appellee? We think the word "class," as used in the statute, means broadly a genus, including as species any goods upon which the use of the same mark when on the goods exposed side by side would tend to mislead the purchasing public."

Value of Trade-marks in Central America.—Commercial Agent Garrard Harris, in an interesting communication calls attention to the fact that it is not generally known nor appreciated as it should be by American exporters that trade-marks play a very important part in lower Mexico and Central America, in fact, a leading part in the sale of foreign manufactures, and appears to think that trade-marks have a greater significance in such countries than in the United States. He says it is not difficult to ascertain the value of these trade-marks and trade names in the countries named, as any storekeeper can give the information, and an investigator can obtain abundant information for himself by spending several hours in a store listening to the inquiries of customers who invariably ask for an article by the trade name or the trade-mark by which it is generally known; and if the trade-mark is something they can see and describe, like a star, a crescent, the sun, or a pine tree or any such object, so much the better.

Trade-mark Showing How Goods are Used.—The Court of Appeals of the District of Columbia in affirming the decision of the Commissioner of Patents refusing registration of an alleged trade-mark for "non-metallic electric vehicle tires" in re the Motz Tire and Rubber Company, said: "Moreover, we agree with the Commissioner that the representation of a rim for a tire with a tire thereon, even though the tire be disclaimed, is not registrable as a trade-mark, for the reason that no manufacturer should be prevented from representing to the public the manner in which his goods are used."

Acquirement of Trade-mark Rights.—The Court of Appelas of the District of Columbia in Consumers Company v. Hydrox Chemical Company says, "It is settled law, in this court, that a trade-mark is not acquired by the invention or the discovery of a word or symbol, or by advertising. It only becomes a trade-mark by attaching or affixing it to certain articles of merchandise."

Trade-marks as Applied to Publications Distributed Free.—In *ex parte* The Curtis Publishing Company Assistant Commissioner Newton, in holding the mark patentable, decided that a publication which is distributed free for advertising purposes constitutes merchandise within the meaning of the trade-mark Act and a mark used on such publications is registerable, saying in his decision "They do not pretend to publish this magazine gratuitously, and it is thought that the office should be liberal rather than restricted in its interpretation of what publications are held as merchandise under the trade-mark statute."

The Trade-marks "Grandmas" and "Mothers."—The Court of Appeals of the District of Columbia in affirming the decision of the Commissioner of Patents in Bromund Co. v. Columbia Wax Products Co., holding that appellee is entitled to the registration of the word "grandmas" over the prior adoption and use of the word "mothers," in which the Commissioner said the words neither looked alike nor sounded alike, the court said in cases of this kind the evidence of the eyes is more persuasive and satisfactory than any other.

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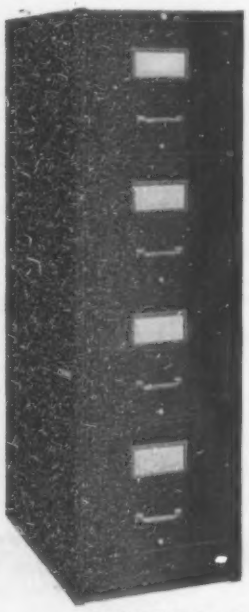

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The Problem of the Hudson River

(Concluded from page 357.)

driven by its own propellers, except within a comparatively narrow belt immediately in the vicinity of the stern.

Changing conditions due to varying widths of channelway were determined by means of vertical walls placed upon the false bottom and held in place by means of bags of sand. Three different widths were examined, i. e., 2,000 feet, 2,400 feet, and the present existing one of 2,800 feet. The moving pictures taken were projected by means of a proper apparatus and upon a scale which permitted them to be studied deliberately and easily. From these data curves were plotted which gave exceedingly instructive information to the experts, and which clearly indicated the extent of the forces and their probable effect.

It would be technically interesting to go into details, but that is not possible here. The net result of the tests showed that a large liner advancing at any speed permitting her navigation against the tide caused lateral disturbances on either side of her extending for a distance of quite 400 feet, i. e., a total danger zone of 800 feet. With increase of speed the force of these perturbations and their menace were augmented proportionately. For vessels moored between piers the effect upon them of passing craft of large size was found to be more serious when the wharves were resting upon open piling than when extending solidly down to the river bed. This revelation had to do particularly with the temporary extension allowed in the case of one of the Chelsea piers for the sheltering of the stern of the "Olympic."

Because of these investigations, the army engineers of the Harbor Line Board emphatically concluded that "the fairway of the Hudson River should not be further decreased, especially in the vicinity of the Chelsea reach." Thus for an outlay of a few thousand dollars data full of warning have been obtained, which may save us from serious mistakes and result, besides, in reducing the dangers to river traffic, and probably mean an economy of many millions of dollars in fuel costs that would certainly have to be borne were the channelway narrowed and tidal velocities augmented.

Dr. Hertoghe on Thyroid Deficiency

AMONG the guests of honor at a dinner given by Dr. William Seaman Bainbridge of the New York Polyclinic Hospital during the recent International Congress of Surgery were many prominent members of the profession, both of this continent and of Europe. The list included Prof. E. Hertoghe of Antwerp; Dr. A. C. Jordan of Guy's Hospital and of the Royal Free Hospital for Chest Diseases, London, England; Dr. Merrill Ricketts of Cincinnati, noted for his researches in intrathoracic surgery; President J. A. Wyeth of the New York Polyclinic Hospital; Prof. Laplace; Dr. Jackson of Philadelphia; Dr. Bruce of Toronto; Dr. Armstrong of Montreal; Dr. Sajous of Philadelphia; Dr. Tinker of Ithaca, N. Y.; and many others.

Prof. Hertoghe, in his after-dinner remarks, gave a most interesting account of his pioneer work in the treatment of conditions due to disorders of the thyroid gland (the gland in the neck, the enlargement of which produces the condition known as goiter). While extreme deficiency of this gland produces unmistakable symptoms, such as dwarfed growth, abnormally low temperature, puffing up of the face, low mental powers (idiocy), in milder cases the symptoms are much less obviously referable to thyroid deficiency, but that this is their true cause is proved by the fact that they yield perfectly to administration of thyroid extract. A number of obscure cases that had baffled physicians were thus made the subjects of spectacular cures. Dr. Jordan showed a number of slides illustrating the use of Röntgen rays for thoracic and abdominal diagnosis, and especially for the diagnosis of "intestinal stasis"—a subject discussed in these pages three weeks ago. Dr. Ricketts illustrated modern advances in surgery on the

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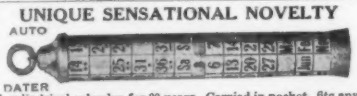

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lungs and heart, organs which until fairly recently were thought almost too vulnerable to permit of operative intervention.

John Henry Poynting

THE world of physics mourns the death of John Henry Poynting, who passed away on March 30th, at his home in Birmingham, England.

Of Poynting's scientific researches no doubt the most important are his contributions to the theory of the electro-magnetic field. In two memoirs, "On the Transfer of Energy in the Electro-magnetic Field" and "On the Connection Between Electric Current and Electric and Magnetic Inductions in the Surrounding Field," he has shown that the flow of energy in such a field takes place in a direction perpendicular both to the lines of electric and also of magnetic force, and can thus be represented in direction and magnitude by a certain vector, which has become known as *Poynting's vector*. The wire "carrying an electric current" is seen to be merely a guide for the electrical energy flow—the flow itself takes place along lines which permeate the entire space about the conductor, and abut perpendicularly against the wire. The energy, so far from "flowing along" the wire, is propagated sideways into it from the surrounding space.

During the later years of his life Poynting devoted much of his attention to the subject of radiation pressure, to which he made important contributions both in its theory and in experiment. He demonstrated the tangential pressure of light, and showed that a beam of light behaves essentially like a stream of momentum. He showed that radiation pressure, though small, plays an important *rôle* in cosmic phenomena. Turning to other aspects of the subject of radiation, he indicated means for determining the temperature of celestial bodies and interstellar space. Of his earlier work the chief was his determination of the general constant of gravitation by means of an ordinary precision balance with an adjustable mass placed under one of the pans. In this way the effect of the adjustable mass was compared with that of the earth itself, so that one is justified in describing the experiment as "weighing the earth."

Poynting was the author of numerous other scientific papers, and the joint author with Sir J. J. Thomson of a series of textbooks of physics. He also published several books of a more popular character.

Poynting was connected with Birmingham University (then Mason College) since its birth, in 1880, and on the coming of age of the institution, in 1901, he was appointed dean of the faculty of science. This office he held until recently, when ill health forced him to restrict his work to his professorial duties.

As a teacher Poynting will be remembered by his pupils as a man possessing in a singular measure the faculty of stirring interest and training the mind to rigorous thinking. Just what such influence means only those know who have actually experienced it.

The principal honors that came to Poynting in the course of his career may briefly be sketched here. At the mathematical tripos he was bracketed third wrangler in 1876, and later gained the Fellowship of Trinity College, Cambridge. In 1888 he was elected Fellow of the Royal Society, whose gold medal was awarded to him in 1905. In 1891 he received the Adams prize, and in 1899 he was made president of section A of the British Association. The meeting of that year is memorable for the announcement, by J. J. Thomson, of the separate existence of electrons. In 1905 Poynting was chosen president of the Physical Society.

We have spoken of Poynting as the investigator and the teacher. Those who knew him as a man need not to be reminded on this occasion of the qualities which endeared him to those so privileged. That modesty and freedom from all hauteur which is the surest sign of a truly great mind, was among the most marked traits of his character. A balance of mind which is not always found in those who achieve greatness in special fields rendered invaluable his opinions and judgments in matters of weight. His heart was as great as his mind. A. J. L.

Air Craft on the Defensive and Offensive

A Review of Recent Experiments

FRANCE is zealously striving to adapt the flying machine to aggressive warfare. Among others, there were begun at the flying field at Buc in October, 1913, tests before a military committee with the so-called "Air Craft Hunter" of Lieut. Mailfert. The flying machine, which was already exhibited at the last Aeronautic Exhibition in Paris, is a Nieuport monoplane of 160 horse-power. It contains in its *fuselage* a shot-sieve or a projectile thrower, an arrangement which, when the pilot sets it in action, strews the underlying ground with two thousand shot. An aiming arrangement is said to be at hand. On the flying field a flying machine was represented to actual scale by means of a disk. Lieut. Mailfert rose in his machine to a height of 2,000 meters and flooded the target with his projectiles. The disk was riddled with many bullets. Then free balloons were released, against which also Mailfert brought his shot sprinkler into action. He succeeded in causing two balloons to sink.

Another kind of aggressive flying machine, the so-called "Zeppelin-Hunter," was put to trial last summer, according to the Paris *Journal*. With its own weight reduced to a minimum, it had to carry an armor of 60 to 70 kilogrammes to protect both the pilot and the more vulnerable parts of the machine. It is intended to provide the flying machine with a light machine gun, which can perforate the Zeppelin hulls with rapid fire shot and ignite the gas.

In January, 1914, an experiment took place also in Villacoublay, with a new armored flying machine, which was built and provided with a rapid-fire gun, according to the directions of the heads of military aeronautics. The ordnance, presumably a machine gun, is claimed to have signal striking capacity. The flight, however, which the pilot, Espaner, effected with the new aeroplane, was not very fortunate.

The French papers emphasize that in future all French military air craft, except the school machines, will be armored to protect them against hostile fire. They may be divided into the following kinds:

1. Armored monoplane for reconnoitering artillery and cavalry. Minimum velocity, 120 kilometers per hour.

2. Armored biplane for reconnoissance work of the general staff at great distances. Minimum velocity, 100 kilometers per hour.

3. Armored biplane which, provided with machine guns, etc., shall destroy hostile aeroplanes and airships. Minimum velocity, 120 kilometers per hour.

4. Large aeroplanes with more seats, for special service.

The Paris Aeronautic Exhibition last fall showed a special number of armored aeroplanes. The armor protection extended not only to the pilot and observer, but also to the provisions, the rudders, the measuring instruments and especially the propulsion system. The aeroplanes not intended for aggressive warfare were for the most part provided with wireless apparatus.

The improvement in the possibility of observation was shown at Villacoublay late in November, 1913, on a new kind of aeroplane in which the seat for the observer is placed forward, directly under the screw propeller. Deputy Girod, piloted by Gobé, flew over the field several times and made effective observations. The capacity for observations from this position is without doubt greater, still the observer in this advanced position is more exposed to hostile fire, and above all is incapable of taking charge of the controls of the aeroplane in case of failure of the pilot.

At Farnborough in England last year a trial of sharp-shooting from aeroplanes was held. A military biplane was provided with a machine gun and ammunition; this gave, from an elevation of 120

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It is safest to buy in original barrels, half-barrels and sealed five and one-gallon cans. See that the red Gargoyle, our mark of manufacture, is on the container.

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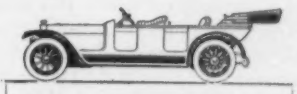

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Alco	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.			
American	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Autocar (2 cyl.)	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (4 cyl.)	A	E	A	Arc.	A	Arc.				
Avery	A	E	A	E	A	A	A	A	A	A
" (Model C)									Arc.	Arc.
Buick (2 cyl.)	A	A	A	A	A	A	A	A		
" (4 cyl.)	Arc.	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (6 cyl.)									A	Arc.
Cadillac	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Carterear	A	E	A	E	A	E	A	E	Arc.	Arc.
" Con't.	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Case			A	A	A	Arc.	A	Arc.	A	Arc.
Chalmers	Arc.	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.	A	A
Chase (air)	B	B	B	B	B	B	B	B	B	B
" (water)									Arc.	Arc.
Cole	Arc.	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Delaunay Belleville	B	A	B	A	B	A	B	A	B	A
E. M. F.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.				
Empire	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.
Fiat	A	E	B	A	A	B	A	B		
Flanders	E	E	E	E	Arc.	Arc.				
" (6 cyl.)							Arc.	Arc.		
Ford	A	Arc.	E	E	E	E	E	E	E	E
Franklin	B	Arc.	A	Arc.	A	Arc.	A	Arc.	A	A
" Con't.	B	A	B	A	A	Arc.	A	Arc.		
G. M. C. Truck					Arc.	Arc.	A	Arc.	A	Arc.
Havers			A	Arc.	A	Arc.	A	Arc.	A	A
" (Model 6-60)									Arc.	Arc.
Haynes	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Hudson	Arc.	Arc.	A	Arc.	A	Arc.	A	Arc.	A	A
Hupmobile (Model 20)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
" (Model 32)									A	Arc.
I. H. C. (air)							B	A	B	A
" (water)							A	A	A	A
International	B	A	B	B	A					
Interstate	A	E	A		A	Arc.	A	Arc.		
Jackson (2 cyl.)	A	A								
" (4 cyl.)	A	Arc.	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
" (6 cyl.)									Arc.	Arc.
Jeffery									A	A
" Con't					Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Kelly			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	A
King			A	E	A	E	A	E	A	A
" Con't									Arc.	Arc.
Kissel Kar	A	E	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
" " Con't				Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" " (Model 48)									A	A
Kline Kar	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
Knox	B	A	B	A	B	A	B	A	B	A
Krit	A	A	A	A	A	A	A	A	A	A
Lozier-mobile	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	E	E
Lozier	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
Mack	A	E	A	E	E	E	E	E	A	E
" (Model B)							A	A	A	E
Marion	A	E	A	E	A	Arc.	A	Arc.	Arc.	Arc.
Marmon	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Maxwell (2 cyl.)	E	E	E	E	E	E				
" (4 cyl.)	E	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (6 cyl.)							Arc.	Arc.	Arc.	Arc.
Mercer	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Mitchell	Arc.	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Moline	A	E	A	Arc.	A	Arc.	A	Arc.		
Moline Knight									A	A
Moon (4 cyl.)	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
" (6 cyl.)									Arc.	Arc.
National	A	A	A	A	A	A	A	A	A	A
Oakland	A	E	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
Oldsmobile	A	E	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.
Overland	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Packard	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
Paige Detroit	E	E	A	Arc.	A	E	A	E	A	A
Pathfinder							A	Arc.	Arc.	Arc.
Peerless	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Pierce Arrow	Arc.	Arc.	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.
" Con't			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Pope Hartford	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Premier	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Rambler	A	A	A	Arc.	Arc.	Arc.	Arc.	Arc.		
Regal	A	E	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Renault	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Reo	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Saxon									E	E
S. G. V.			E	Arc.	B	Arc.	B	Arc.	A	Arc.
Selden	A	E	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Simplex	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Speedwell	Arc.	Arc.	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.
" Monel							A	Arc.	B	A
Stearns	Arc.	Arc.	A	Arc.	A	Arc.				
" Knight					A	A	A	A	B	A
Stevens Duryea	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Studebaker-Dayton	Arc.	Arc.	A	A	A	A	A	A		
" Knight					A	A	A	A		
Studebaker	E	E	A	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Stutz				Arc.	Arc.	Arc.	Arc.	Arc.	A	A
Velie (4 cyl.)	A	E	A	Arc.	A	Arc.	A	Arc.	A	A
" (6 cyl.)									Arc.	Arc.
Waites	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
White	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Winton	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.

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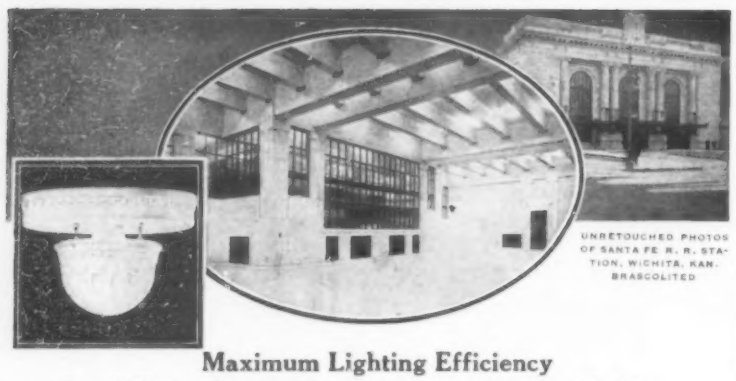

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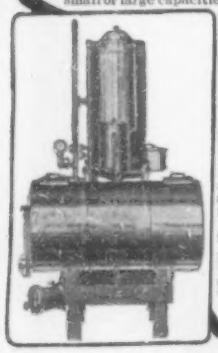

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meters, 20 shots directly downward. As to its striking capacity and effect, nothing has been reported; the recoil from the shot was without notable influence on the equipoise of the aeroplane.

Also a Birmingham society instituted at Bisley sharp-shooting at an aeroplane with a machine-gun. The 26-pound, air-cooled machine-gun invented by Col. Lewis was fixed on a tripod on the aeroplane framing; on a tripod was also placed the movable seat for the protection of the aviator. Out of thirty shots at a target space of 20 feet, 11 hits were scored. From what elevation the aeroplane fired has, however, not been reported, nor the velocity of the air craft, nor the kind of target arrangement.

A sighting arrangement for machine guns on air craft has lately been patented. The machine gun is fixed between the legs of the observer sitting forward and having charge of the gun. The aviator sits elevated behind the observer. The fore part of the aeroplane is covered with a hood which carries on top a notch and sight. When the target is in sight the observer calls to the pilot and adjusts the sighting arrangement for distance and altitude. The aviator directs the aeroplane at the target by use of the rudders in conjunction with the notch and sight. When the observer perceives that the direction coincides he promptly fires.

An aeroplane projectile with rear rudder has been made in England. A tube extends lengthwise through the middle of the cylindrical projectile, filled with explosive. It carries, in front, trigger pins and percussion caps separated by an interspace, and having well to the rear an ignition charge. Both parts are secured by bolts fixed to the aeroplane frame, and, through the projectile, interlock in the tube, and so protect the aeroplane from destruction by its own discharge due to hard landing, shocks, etc. The part of the tube extending to the rear of the projectile carries the tail rudder. The projectiles hang on two hooks perpendicular to the floor of the aeroplane frame. When the projectile is to be thrown, the aviator establishes a special relation between the measured altitude and the velocity of flight, aims at the target, and, by means of a hand lever, releases the supporting arrangement of the projectile. The projectile, now free, sets itself point downward by means of its tail rudder. Since the two safety bolts have remained behind in the aeroplane, the igniter is in working condition, and when the projectile strikes, the trigger pin pierces the percussion cap, ignites the ignition charge, and this sets off the explosive charge of the projectile.

Shooting at aeroplanes was carried on last year in the camp at Chalons. A kite seven meters in width by six meters in length, represented an aeroplane and was towed by an automobile and wire cable with a velocity of 60 kilometers per hour. It was fired at by two squads of infantry, of fifty men each, at a distance of 800 to 900 meters. Out of nine hundred shots (nine cartridges for each man) twelve hits were scored on the kite, that is 1.3 for each man. A second shooting, with the same number of men, at a small kite, measuring 1.5 meters broad by 1 meter long, gave 0.5 shot per man, but at a distance not reported. Machine guns were trained against the same target, but with less effect.

A Spanish aeroplane was hit last November by Moroccans. Capt. Barreiro and Lieut. Gil-Rios undertook, in a reconnoissance on a military biplane, to observe the position of the insurgents. In this they were subject to fire by a group of hostile troops which had got footing on Conical Mountain. The lieutenant was grievously injured by two shots, the captain was wounded by one shot. It was possible for the officers, in spite of their wounds, to fly back again to their own camp—a proof, therefore, that even effective fire does not always put an aeroplane out of commission, and that an energetic aviator, even in spite of his wounds, will often carry out his orders.

[Translated for the SCIENTIFIC AMERICAN from *Kriegstechnische Zeitschrift.*]

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Patents Which Expire in 1914

THE United States patents issued in 1897 for seventeen years will expire on corresponding dates in 1914. Among the important patents which will expire in 1914 are as follows:

In machines for cultivating a number of rows of crops is the patent to Davis, 576,039, January 26th, 1897; the swing or hammock cultivator patent to Sobey, 578,502, March 9th, 1897; the harrow patent to Sharp, 589,797, September 7th, 1897, and that to Ryder, 585,941, July 6th, 1897, which shows harrow teeth and supporting wheels at right angles on rocking tooth bars, so that as one device is thrown out of operation the other is thrown into operation; the check rowing, drilling and hand dropping planter patents to Lindgren, 577,437, February 23rd, 1897, and to Dooley, 593,295, November 9th, 1897; the Eltzroth patent, 579,049, March 16th, 1897, for a broadcast seeder in the form of an attachment that can be substituted for the end board of an ordinary farm wagon; the corn harvester patent to Ellis and Stewart, 577,105, of February 16th, 1897; the Sauer, 576,510, February 2nd, 1897, relating to the production of various kinds of wine from malt by the aid of properly selected grape ferments; the Swenson patent, 591,304, October 5th, 1897, for the volute type of cotton press; the Lowry patent, 581,601, April 27th, 1897, for a cotton press in which the cotton is fed under great pressure through a rotating head, also the Lowry cotton press patent, 581,600, of April 27th, 1897; the Hudson, 587,826, of August 10th, 1897, for a cigarette machine in which the ends of the paper are tucked around the tobacco as in certain handmade cigarettes; the Campbell, 579,422, of March 23rd, 1897, for making the well-known elliptical cigarettes; the cigar machine patent of Bunn, 579,859, of March 30th, 1897, in which the rollers are composed of short sections to adapt them to fit various forms of bunches; the Underwood patent, 591,436, of October 12th, 1897, for tobacco leaf stemmer in which the leaf is fed stem first between the stripping rolls until gripped by gripper rolls; the Fargo patent, 583,143, of May 25th, 1897, combining a churn and a butter worker; patent to Vidal, 594,105, November 23rd, 1897, for an artificial die made by heating synthetic substances with sulphur and sodium sulphide; the Tiemman's patents, 583,719 and 583,720, of June 1st, 1897, relating to improvements in synthetic perfumes, the patents being for aromatic ketones; the artificial camphor patent to Nagel, 582,221, of May 11th, 1897; the patent to Constam, 579,317, March 23rd, 1897, for a process of making percarbonates for bleaching purposes; the Carr patents, 583,565, of June 1st, 1897, and 581,335, April 27th, 1897, for dental bridge-work; the Wildprett patent, 577,866, of January 26th, 1897, for ladders for store service; the Knight patent, 587,442, of August 3rd, 1897, for a simple scheme for the transition of two or more electrical motors which may be connected in series, in parallel or in any relation of series and parallel; the Schimpf, 582,237, of May 11th, 1897, for the application of electricity to agriculture apparatus; the Cox patent, 585,257, of June 29th, 1897, for electric meter to give different readings in accordance with the rate of charges where different rates for electric service are charged; the hydraulic motor patent, 595,027, to Westinghouse of December 7th, 1897, in which a rotary pump connects with the two ends of the power cylinder and pumps the water from one end of the cylinder to the other to move the piston; the hydraulic press patents to Parfitt, 579,441, March 23rd, 1897, and to Winans, 582,839, of May 18th, 1897; the patent to Gulick, 579,265, March 3rd, 1897, for clamping means for the tubes of bicycles; the Forg patent, 581,907, of May 4th, 1897, for reducing weight in parts of bicycle constructions; the motorcycle patent, 583,809, of June 1st, 1897, to Libbey; the Streeter patent, 595,588, of December 14th, 1897; the Sargent patent, 587,493, of August 3rd, 1897, and the Babcock, 580,920, of April 20th, 1897, for brake-shoes for railway cars; the Schoen patent, 584,709, of June 15th, 1897, for steel hopper-bottom cars; the Hardie patents, 577,024, of February 16th, 1897, and 580,827, of April 3rd, 1897, in which the car or locomotive reservoir in air storage motor cars is charged from a stationary plant; the electric motor-vehicle patents of Morris and Salom, March 30th, 1897, 579,890; Maxim patent, November 30th, 1897, 594,805; Woods patent, June 29th, 1897, 585,371; the patent to Morris & Salome, 578,651, of March 9th, 1897, in which separate motors for the driving wheels, for ease in turning motor vehicles, is shown; the patent to De Dion & Bouton, 593,877, November 16th, 1897, for a sparking igniter, and the patents to Westinghouse and Ruud, 583,584, 583,585, and 583,586, of June 1st, 1897, for charge feeding, speed regulating and igniting mechanisms for gasoline engines; the Maxim patents, 593,227 and 593,228, of November 9th, 1897, for automatic heavy ordnance; the patents to Browning, 580,923, April 20th, 1897; Ehbets, 580,935, of April 20th, 1897; to Manlicher, 581,295 and 581,296, of April 27th, 1897; to Mauser, 584,479, June 15th, 1897, and to Burgess, 589,120, of August 31st, 1897, for fire-arms (small arms); the Gathmann patent, 583,042, of May 25th, 1897, for projectile in which the explosion of the detonator is rendered harmless, being contained in a relatively large chamber and separated from the bursting charge by a movable metal barrier; the Schlick patent 594,288, November 23rd, 1897, for compound marine engine; the Symington patent, 581,789, of May 4th, 1897, for preventing compression in locomotive cylinders when drifting; the Curtis steam turbine patent, 530,210, of September 21st, 1897; the lubricator patent to Jones, 584,688, of June 15th, 1897, in which the feed of lubricant is automatically controlled by variations in the periods of its action; the Bowen patent, 583,668, of June 1st, 1897, showing an oil cup; the Porter and Hennessey, 587,272, of July 27th, 1897, for lubricator in which the oil is displaced by condensation of steam; the fuel briquetting patent to Batter, 580,568, of April 13th, 1897; the patents for acetylene machines in which carbide is fed to water as in patents, 575,281, to Buffington, January 12th, 1897; to Fuller, 575,474, January 19th, 1897; to Deuther, 567,955, February 9th, 1897; and to Rhind, 583,582, June 1st, 1897; Altenbaugh patent, 584,138, of June 8th, 1897, for a glass machine in which glass is gathered from a tank or furnace and delivered to a mold for making tumblers; the Hay patent, 582,587, May 11th, 1897, for an improvement in the utilization of the heat of cooling clinker of a cement kiln; the Garchey patent, 587,809, August 10th, 1897, for making imitation stone from waste glass; the Goldsmith patent, 578,868, of March 16th, 1897, for process of reducing refractory oxides; the patent to Abbott, July 27th, 1897, for machine for automatically forging horse-shoe nails; the patents to Locke, April 13th, 1897, 580,579, and to Viellard and Oswald, 580,564, April 13th, 1897, for automatic machines for cutting, bending and shaping links for drive chains from a continuous strip and assembling them into a chain; the gear cutting machine patents to Fellows, March 30th, 1897, 579,708, and to Warren, 588,738, of August 24th, 1897, in which the cutter bears to the blank being cut the relationship of an intermeshing gear; the incandescent gas mantel patent of Cortis, May 4th, 1897, 581,879, in which the life of the delicate mantel is prolonged by carrying the burner on springs; the Fuller patent, 580,126, April 6th, 1897, for burner designed to burn acetylene gas; the Cornell patent, 590,792, of March 30th, 1897, for machine for pasting labels on bottles, in which the label is sprayed with an adhesive and then spread upon the bottle; the patent, 583,072, May 25th, 1897, to Munson for making shucks for match boxes by refolding; the Noble patent, 586,054, July 6th, 1897, for machine for making paper tubes by forming continuous tubing by a spiral wind; the Potter patent, 574,493, January 5th, 1897, for printing press, including means for associating delivery and folding the product of the rotary press; the Harris & McNutt patent, 577,405, February

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Total Payments to Policyholders, since organization, over	300 Million Dollars
Number of Policies in Force	12 Million
Real Estate Mortgages and Farm Loans, over	92 Million Dollars
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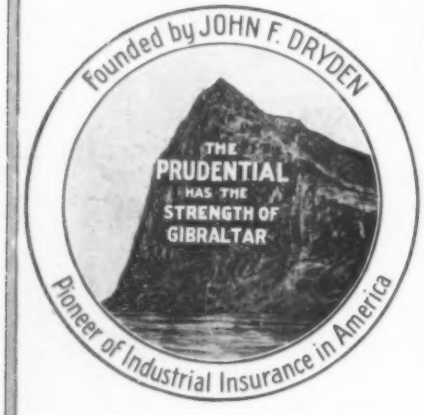

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16th, 1897, for rotary printing press, especially adapted for printing on cards and envelopes; the Wood patent, 589,519, September 7th, 1897, for means for preventing the off-set of fresh reprinted ink in printing presses; the typesetting machine patent to Ennisson & Honiss, 583,224, March 25th, 1897, which selects proper justifying spaces from a magazine; the type distributing machine patent to Cox, 578,216, March 2nd, 1897; the Dexter patent, 588,635, August 24th, 1897, in book-binding; the patent, 580,111, of April 6th, 1897, to Jacobs for machine for applying cloth book covers; the Johnson patent, 584,363, June 15th, 1897, for linotype machine improvement; the patent to Skursheedt et al., 591,079, October 5th, 1897, for mechanism for automatically feeding and stitching spangles to a foundation fabric; the patent to Reed, 580,531, April 13th, 1897, for a wood-turning machine for turning shoe lasts; the Fischer patent, 595,911, December 21st, 1897, for electrically operated clocks; the patent to Kellog, 591,169, October 5th, 1897, for automatically operating time-operated mechanisms; the patent to Brachhaussen, 596,393, December 28th, 1897, for automatic musical instrument; the musical instrument of Cahill, 580,035, April 6th, 1897, in which electrical vibrations corresponding to the notes of the musical scale are produced and combined by keyboards to correspond to chords collected on wire and transmitted to loud speaking telephones; the Olivary patent, 583,077, May 25th, 1897, for changing the pitch of larinates by partly filling the bore without affecting the finger holes; the patents in optics to Armat, 578,185, March 2nd, 1897, and Abbe, 584,976, June 22nd, 1897; the patent to Holport, 579,434, March 23rd, 1897, for boat lowering and detaching device adapted to release the boat on its being water borne; the Sinty patent, 581,625, April 27th, 1897, for reversing the angle of screw propeller blades for use with non-reversible engines; the Kaselowsky patent, 591,768, of October 12th, 1897, for automatic steering devices for boats adapted to operate on the principle of the gyroscope; the patent to Curtiss, December 28th, 1897, 596,294, for safes in which the dogging devices are held normally inoperative by thermostatic device released upon a rise of temperature; the all-glass show case patent of Ganter, 584,584, June 15th, 1897; the patent to Hale, 595,624, December 14th, 1897, for mechanism for reversing car seats, and the Johnson patent, 582,926, of May 18th, 1897, for artificial sponges for surgeons' use.

Napier Tercentenary Celebration, July, 1914

JOHN NAPIER'S *Logarithmorum Canonis Mirifici Descriptio* was published in 1614; and it is proposed to celebrate the tercentenary of this great event in the history of mathematics by a congress, to be held in Edinburgh on Friday, 24th July, 1914, and following days.

The celebration is being held under the auspices of the Royal Society of Edinburgh, on whose invitation a general committee has been formed, representing the Royal Society of London, the Royal Astronomical Society, the Town Council of Edinburgh, the Faculty of Actuaries, the Royal Philosophical Society of Glasgow, the Universities of St. Andrews, Glasgow, Aberdeen, and Edinburgh, the University College of Dundee, and many other bodies and institutions of educational importance.

Through the SCIENTIFIC AMERICAN, the president and Council of the Royal Society of Edinburgh have now the honor of giving a general invitation to mathematicians and others interested in this coming celebration.

The celebration will be opened on the Friday with an inaugural address by the Rt. Hon. Lord Moulton, F.R.S., LL.D. (Edin.), etc., followed by a reception given by the Right Honorable the Lord Provost, magistrates and Council of the city of Edinburgh. On the Saturday and Monday the historical and present practice of computation and other developments closely connected with Napier's discoveries and inventions will be discussed.

A memorial service will be held in St. Giles's Cathedral on the Sunday.

Among many who have expressed a warm interest in the celebration and who hope to take part in the congress, may be mentioned Prof. Andoyer, Paris; Prof. J. Bauschinger, Strassburg; Prof. Hume Brown, Historiographer Royal for Scotland; Prof. F. Cajori, Colorado, U. S. A.; Prof. G. A. Gibson, Glasgow; Dr. J. W. L. Glaisher, Cambridge; Prof. Lang, St. Andrews; Prof. Macdonald, Aberdeen; Prof. E. Pascal, Naples; Prof. Karl Pearson, London; Prof. Eugene Smith, New York; Prof. Steggall, Dundee; Prof. Whittaker, Edinburgh.

Merchiston Castle, the residence of Napier, has long been occupied by the well-known public school, which draws pupils from all parts of the British Empire. The governors of the school have kindly invited the members of the congress to visit the castle and grounds on the Saturday afternoon.

Relics of Napier, collected by Lord Napier and Ettrick and other representatives of the family, will also be on view; and it is intended to bring together for exhibition books of tables and forms of calculating machines which may reasonably be regarded as natural developments of the great advance made by Napier.

Individuals, societies, universities, public libraries, etc., may become founder members on payment of a minimum subscription of £2; and each founder member will receive a copy of the memorial volume, which will contain addresses and papers read before the congress, and other material of historic and scientific value. It is important to secure as many founder members as possible, so that a volume may be brought out worthy of the memory of Napier.

Ordinary subscribers (5s.) attending the celebration may receive copies of the memorial volume at a reduced price.

Subscriptions and donations should be sent to the honorary treasurer, Mr. Adam Tait, Royal Bank of Scotland, St. Andrew Square, Edinburgh.

All who are interested in this proposed celebration are respectfully invited to communicate with the general secretary of the Royal Society of Edinburgh, 22 George Street, Edinburgh, and to announce their intention of being present.

Sound Perception v. Deafness

By Stanley Robinson

VERY few people are aware of the fact that totally deaf persons are really conscious of the noise they themselves make, or of the noise made by other persons or things, when such noises are made near enough to be communicated to their bodies.

The fact that the deaf, scientifically speaking, possess diaphragmatic hearing is known only to their friends and instructors. They hear, or rather feel, the concussion of many sounds almost as well as hearing people, through the vibrations on their ear diaphragms, these vibrations reaching the brain through the medium of the nerves of feeling.

I have not a particle of hearing myself, and write chiefly from my own experience, knowledge, and life-long association with the deaf. A totally deaf person is much like a man with his ears plugged up with cotton and thickly bandaged. Were the bodies of deaf mutes not sensitive to such sounds and noises as they feel or come in contact with, I fear they would be in a sphere of too great a silence. Noises make the deaf feel that they are not really deaf. Strange to say, sounds are often troublesome. The deaf often feel grateful that they can enjoy the benefit of so much silence as they do. Much of the time they are undisturbed by all the harsh sounds which agitate the ears of the hearing community.

Such sounds as are perceived or the sounds that come in constant contact with the persons of the deaf are often a help rather than a bother.

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truck. The noise of the truck on the cobblestones has simply been communicated to the man's body by vibrations. Had it been a rubber-tired vehicle drawn by a team of horses, the man would have been unconscious of its presence, because rubber-tired vehicles, as a matter of fact, produce no vibrations, and very little noise. The footsteps of the horses do not cause a sufficient noise for the man to feel, as they are too far away from him. The footsteps of a horse may be distinctly felt by a totally deaf person, provided he is near or within the required distance to feel the sound. The distinctness of the sound depends very much upon the kind of material on which the horse is walking. Thus if a horse is stamping on soft ground in order to remove an annoying fly, and the totally deaf man is but a few feet from him, the noise will appear to the man, for he will feel it as a dull thud. If, however, the horse is stamping or walking on a boarded surface, or platform, the deaf man will exclaim, "Oh, what a noise!"

Vehicles produce no vibrations when the streets are covered with snow or mud. Consequently, they are just as noiseless as rubber-tired vehicles. A deaf mute may pass throngs of people on the street, and yet not feel the sound of a single footstep. The only noise he will perceive will be the rumbling of some passing vehicle; also on an unpaved thoroughfare the sound of wagons or heavily laden trucks can scarcely be felt.

In many ways stone is a poor material for the conduction of noises to the body of a deaf mute. He will not feel the noise if you stamp on a stone pavement unless you are close to him.

A deaf mute will be conscious of all the noise in the room which he occupies. He will feel the door slam, the fall of a ball, an apple, an orange, a key, or any other weight; the footsteps of persons in the room, if it is not carpeted, or if they do not have on rubber shoes or slippers; also the noise he makes with his own knife and fork when eating.

Shortly after I became deaf, at the age of ten, I did not realize that my deafness was total, simply because through my sense of feeling I was still familiar with most sounds. But when I could not feel human voices, the fact was clearly established that I had not a particle of hearing left. A deaf man feels sounds better when they are near or when he has hold of hollow bodies, such as empty boxes, closets, iron or wooden pillars, which take sound vibrations better than solids. Placing my hand on the panel of a closet door, I am able to feel faintly the thundering noise of a bass drum three hundred feet or more away. I can scarcely perceive such a deafening noise the same distance when standing against a wall of stone.

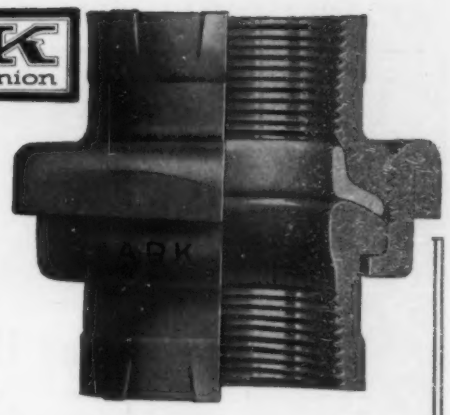
Door Bells and Alarm Clocks.

A deaf person never feels the sound of a bell as its vibrations are confined solely to the atmosphere. I think there is no way by which the sound of such an instrument can be imparted to our feelings. On account of this draw-back every deaf mute who lives alone finds it necessary to arrange some kind of a device which will serve him either through his sense of vision or his feelings, as suitably as the ringing of the door bell serves any hearing person. Many of these devices, only a few of which I shall describe here, are very ingenious and novel as well as useful.

Deaf mute parents that have hearing children or hearing persons living with them, of course, need no substitute for their door bell. Families whose members are all deaf, or who have no hearing persons living with them, often have a dog whose barking and actions, when the bell rings, "hears" for them. Families that reside in houses that are no better than fire traps should always be ready to escape and save their lives in case of fire.

We do not always feel safe when asleep, because if a fire should occur we would not know it or would not be aroused in time by persons trying to save us by knocks and kicks at our door. Only a few months ago the school for the deaf at Malone, N. Y., was destroyed by fire, but as the pupils were well drilled to meet such an emergency, no one was injured.

THE MARK Cold Drawn Steel Union



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Cast **brass** unions expand more **rapidly** than wrought pipe, and spread away from the pipe under heat, making such joints leak when hot.

Unions made of part malleable iron and part cast brass suffer **internal** trouble every time temperatures change; and leak **in themselves.**

The Mark Union is made wholly from wrought steel, with a soft **drawn brass** seat ring or gasket inserted in the female seat. When this brass gasket expands under heat, it tends to render the joint even tighter. It is so soft, and the densified steel male seat that cushions into it is so exceedingly hard, that the Mark Union is proving its ability to hold unprecedented steam and hydraulic pressures under conditions in which every other form of union has failed.

Mark Unions are Sherardized—a process that alloys zinc with the steel. This sherardizing is done **after** the threads are cut, protecting **all** surfaces from rust or corrosion.

Mark Unions are stronger than the pipe, because heavier than the pipe, and made of stronger metal than the pipe itself. Their superiority in this direction is particularly noteworthy in the larger diameters, where all other unions fall so far short of the proper factor of safety.

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Such schools employ hearing night watchmen, as they are more suitable for such work.

Visiting a married mute couple in Brooklyn one day, I inquired how they could tell when their door bell rang so as to respond to it, they having neither dog nor children to hear for them. They showed me a hollow rubber ball suspended from the chandelier in their kitchen, where it could be seen from the parlor and the other rooms in the house. In an ingenious way the ball was attached to the hammer of the door-bell by means of a string, so that whenever the bell rang the hammer would jerk the string and cause the ball to oscillate for some length of time. The swaying of the ball told the busy housewife when someone was at the door. Many families have similar devices. While visiting this same family, the deaf man took me to the foot of his bed. There I found attached to the top bar of the bedstead an alarm clock. "This clock," said he, "awakens me every morning just when I want to get up. I feel the vibration of the alarm quite plainly, as it extends to all parts of the bed."

In the kitchen of another deaf couple living alone in New York city, I found that whenever their door bell rang, an American flag placed in an upright position in front of a window, would fall. When the occupant of the room saw that the flag was down, she or he would know what to do.

A deaf mute doing business in a New York city office has the door bell attached to the electric lamp over his desk in such a manner that the light goes out whenever there is a ring. The sudden vanishing of the light causes the busy man to make a quick response.

Anthropological Exploration in Peru

THE Smithsonian Institution has just issued a second report concerning the field work of Dr. Ales Hrdlicka of the National Museum, carried on in Peru during the past year, in connection with the Panama-California Exposition at San Diego, for which a very important exhibit in physical anthropology is being prepared. The investigations extended over several hundred miles of the Peruvian coast and over hitherto unexplored regions in the western Cordilleras. The objects of this trip, which occupied the first four months of 1913, were to determine the relations of the ancient Peruvians of the mountains with those of the coast, and to extend the investigations which Dr. Hrdlicka has carried on for many years regarding Indian and especially pre-Columbian pathology dating back about 500 years.

The expedition was a very strenuous one, but proved remarkably successful. Over 100 ancient cemeteries and many ruins, a large percentage of which were previously unknown to science, were examined and over 30 boxes of skulls and other material for future study were collected for the United States National Museum and the Museum at San Diego.

The writer reports that skeletal material, which formerly abounded in Peru, and is essential to scientific research, is fast disappearing, and in a few years cannot be gathered without the expenditure of much time and money.

The results of the expedition will prove of unusual value to anthropology. While some of the links of the chain of evidence are still wanting, it can now be said with certainty that the Peruvian coast from Chiclayo, in the north, to Yauca, in the south—a distance of over 600 miles—was peopled predominantly before the advent of the whites by one and the same physical type of Indian. These Indians were of medium height, with short and broad skulls, and moderately to strongly developed muscles according to the locality. The most important fact ascertained in this connection was that both the Chimu and Nascas, two of the foremost cultural groups of ancient Peru, were identical, and as regards physical characteristics, inseparable parts of this coast people.

According to their location, the people of old Peru were either fishermen or farmers. They seem to have been organized in-

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to numerous political groups, which developed smaller or greater cultural differences according to environment and other influences.

Some of their smaller dwellings were made of reeds, while larger structures were built of small uncut stones, sun-dried brick, or blocks of adobe. Their knowledge of weaving, pottery-making, and decoration was surprising. They wove from native cotton and llama wool, and their designs indicate the changes brought about by time and other influences. The native dress consisted principally of a poncho shirt, a loin cloth, and sandals, with simple head gear.

The pre-Columbian Peruvians of the coast knew the uses of gold, silver and copper, and worked these metals to some extent, especially copper in the manufacture of weapons. Their common weapons were a metal or stone mace, a wooden club, a copper ax and knife, the sling, and in some regions the bow and arrow. Their implements were the whorl, weaving sticks, looms, cactus-spine or bone needle holders, sharpened sticks, copper knives and axes, hoes, and fishing paraphernalia, including nets, sinkers, reed-bundle boats or balsas, and peculiar rafts which were paddled.

Throughout the whole territory along the coast the people deformed the heads of their infants by applying pressure to the forehead, probably by means of bandages and pads, which process flattened the back of the head as well. They did not practice filing, cutting, or chipping the teeth, or other mutilations which would leave marks on the skeletons.

It is interesting to know that these natives seem to have been comparatively free from general bodily ailments before the advent of the white men, although they suffered from several peculiar local diseases affecting the hip-bone, the head, and the ear. The people of the mountains possessed a good, average development of the body and of the skull, and were freer than the coast people from disease. It is evident that in some of the districts serious wounds of the head were frequently followed by the operation known as trepanning, and although this was often crudely done, it was successful in many cases. This practice was probably carried on even after the coming of the Spaniards.

The results of the expedition failed to strengthen the theories of the antiquity of man in Peru, but tended to prove the contrary. Aside from the cemeteries or burial caves of the common coast or mountain people, and their archeological remains, there was no sign of human occupation of these regions. Not a trace suggesting anything older than the well-represented pre-Columbian Indian was found anywhere; and neither the coast nor the mountain population, so far as studied, can be regarded as very ancient in the regions they inhabited. No signs indicated that any group occupied any of the sites for even as long as twenty centuries; nor does it seem that any of these people developed their culture, except in some particulars, in these places.

Dr. Hrdlicka's report is issued in the Smithsonian Miscellaneous Collections, publication 2246, and forms an exceedingly valuable addition to the anthropological works of Peru. It comprises 69 pages of text and 26 plates of illustration, showing specimens collected, locations of the finds and maps of the territory explored.

The Guns of Panama

(*Concluded from page 363.*)

mounted upon the Crozier type of disappearing carriage, are scarcely less deadly than their larger brothers, or sisters, for guns have been tacitly endowed with feminine appelatives. Although the 14-inch shells weigh but 1,660 pounds, their range is practically that of the sixteens, at extreme fighting range, and they are able to penetrate any armor now in use.

The main defense of a system of seacoast fortification is found in the mortars. Costing less to manufacture, and projectiles and charges costing less, they are used in great numbers; and the effective range is slightly more than that of the rifles on the disappearing carriages. Fired at extremely high angles, their projectiles invariably plunge directly down upon the target, and though the velocity is comparatively low, no deck armor can withstand them.

The mortars are sunk in pits, in groups of two, each group manned by a company of coast artillery. They are seldom fired singly. As a rule a number of them are directed upon a target and fired simultaneously, a salvo, and in such a hail of steel, directed upon a common objective, at least one projectile, ship-disabling in its power, will most probably strike with deadly effect.

No definite information is given out by the War Department about the number of guns to be in the completed defenses of the Panama Canal, but at such an important point it is reasonable to suppose that it will be ample.

At a rough estimate there will probably be two or more of the 16-inch rifles, from twelve to twenty of the fourteens, and approximately forty mortars, with a large number of the smaller rapid-fire guns.

Assuming the maximum, a hostile squadron would be greeted at each discharge of the entire armament with a composite thunderbolt weighing forty tons—forty tons of disabling, death-dealing steel each minute.

The old naval guns of our Spanish-American war period are obsolete. The guns of the civil war class are playthings; and all guns antedating that period of interstate war are as harmless to a modern dreadnought or emplacement, at any range, as the beating of the rain upon the sea.

And fifty years hence our latest perfection that we esteem so deadly will be smiled at in some musty old museum!

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Length, inches	590	579	200
Weight, pounds	284,000	138,000	34,000
Powder charge, pounds	650	320	80
Shell, length, inches	70	62.6	50–39
Shell, weight, pounds	2,400	1,660	1,046–700
Range, yards	18,600	18,000	19,000
Penetration, inches	17 all ranges 25 muzzle	13	any deck armor
Rapidity of fire	1 per minute	1 per 40 seconds	1 per minute

Insects in the Upper Air

DR. E. EVERLING of Halle, Germany, is trying to interest aeronauts in making observations of the occurrence of insects at altitudes of several thousand feet above the earth's surface. Very few such observations have heretofore been recorded. Dr. Everling himself, in the course of many balloon voyages, has only once noted an insect (a butterfly) at a great altitude. It was, in all probability, carried thither by the strong uprush of air in an incipient thunderstorm, and it may be a general rule that insects do not voluntarily rise above a moderate elevation. Aeronauts are invited to send their observations on this subject to Dr. A. Japha, Zoologisches Institut, Halle a. S., Germany. The meteorological conditions, and especially indications of the presence of strong vertical air-currents, should be noted in connection with all observations.

Meteorological Conference in Scotland.—It is the custom of British meteorologists to hold a breakfast or luncheon in connection with the annual meetings of the British Association for the Advancement of Science. As the Association is to meet this year in Australia, and few meteorologists from Great Britain will be able to attend, arrangements are being made to hold a conference of observers and students of meteorology and allied subjects in Edinburgh early in September.

—thinking of life insurance?

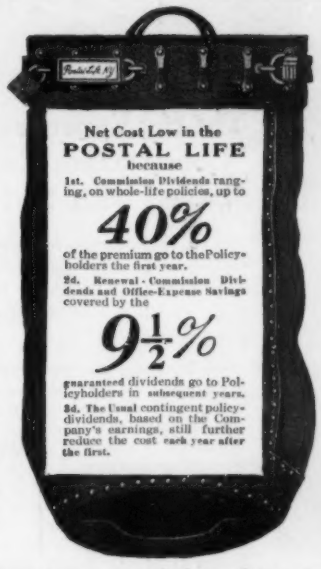
MOST people **are;** for insurance protection is an **ever-present proposition:** it safeguards the home; takes care of the mortgage; educates the youngsters and provides old age independence.

It's on the minds of most people—the thoughtful, humane kind: they're thinking about it good and hard and some 20-000 life-insurance agents are helping them.

The agent, of course, is bent on earning a commission and, incidentally, on beating his last year's record under urgent pressure from his company.

But don't let him do it at **your expense,** for if you take a policy through **any agent, his commission** will come out of **your premium**—the first year and thereafter.

This, of course, will make your insurance cost you more than though you applied **direct** to the **one American company that operates without agents, namely:**


Net Cost Low in the
POSTAL LIFE
because
1st. Commission Dividends ranging, on whole-life policies, up to
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of the premium go to the Policyholders the first year.
2d. Renewal-Commission Dividends and Office-Expense Savings covered by the
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guaranteed dividends go to Policyholders in subsequent years.
3d. The Usual contingent policy-dividends, based on the Company's earnings, still further reduce the cost each year after the first.

AGENTS of all the other companies—the 20,000—find it hard to compete with the Postal Life, and it is therefore best not to believe what such agents say about the Company or what they show you in some easily-influenced insurance periodical.

The Postal Life is a highly accredited institution and has the confidence of all thoughtful insurers who take the trouble to find out about it **for themselves.**

They find that the Postal gives **all** that other companies give and **much** that they **do** not or **cannot** give.

For example: the **Postal's Health Bureau performs a most important service in health-conservation by issuing timely Health Bulletins for the benefit of its policyholders and by providing for those who so desire one free medical examination each Year**—a privilege not accorded by any other company. **It will thus be seen that the Postal**

The Postal Life Insurance Company **Saves you Money and Safeguards your Health**

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WM. R. MALONE, President

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Sixth: *Policyholders' Health Bureau* arranges one free medical examination each year, if desired.

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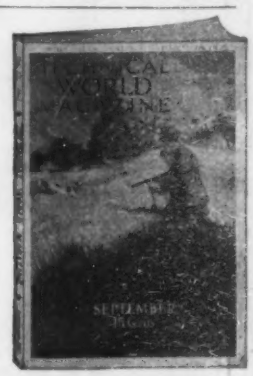

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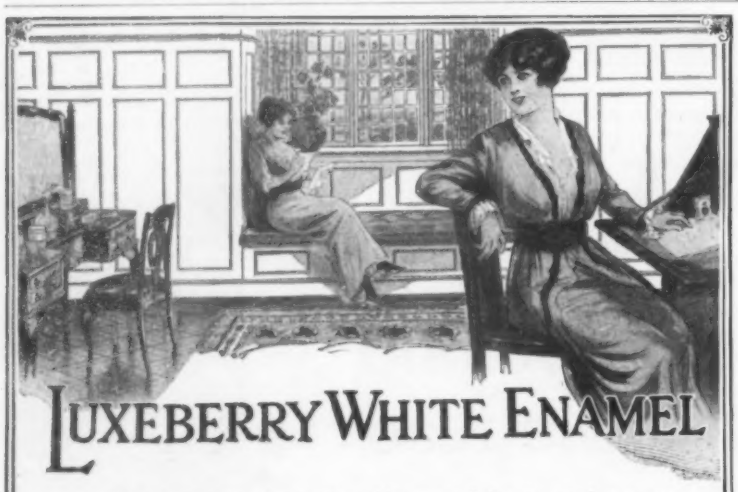

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(12981) O. O. B. asks: Can you please advise me if it has been positively proved that the electron theory of electricity, or, in other words, the one-fluid theory, is correct? That is to say, that it has been proved that positive electricity is fixed, while negative alone is movable? A. The theory of electrons is firmly believed by most scientists. It probably may be said that it is proved as positively as any theory which may be modified at any time by some new discovery. No theory in science is regarded as absolutely proved. A theory is a statement which covers the phenomena to which it applies better than any other explanation. If another better explanation is found, the old will be forced to give way to the new. A recent work by J. J. Thomson, "Rays of Positive Electricity," pertains to this topic. We send the book for $1.40 postpaid.

(12982) M. A. G. asks: Will ultra-violet light penetrate ordinary glass, and also "Jena" glass, sufficiently strong enough to make an imprint on a photographic plate after it has passed through the above said glass? All visible light being excluded. Some works which I have referred to, state that glass cuts off all ultra-violet light, while others state that nearly all of the ultra-violet light passes through. A. Glass is somewhat transparent to ultra-violet rays. We use a cobalt blue glass, combined with a violet glass colored with manganese, and we can get very good ultra-violet effects. By the use of quartz lenses and prisms we can secure much better effects beyond the violet of the spectrum which is formed. You will find about this in a very interesting book by S. P. Thompson, entitled "Light, Visible and Invisible," price $1.75 postpaid.

(12983) E. G. M. asks: 1. In your paper of January 10th, 1914, page 43, you speak of the "daylight-saving fallacy." What is that? A. The daylight-saving fallacy is that it makes a difference which hours men work if they only work the usual number of hours in the twenty-four. In some parts of Europe riots have been narrowly averted over this question, when it was proposed to have the men begin at an earlier hour in the morning so as to close the day's work earlier in the afternoon, and have time for the garden or other out-o'-door pleasures. 2. Would not people surely remain out of doors more, walking, playing, if daylight lasted longer after the day's work was over? I notice in the papers that some city near the dividing line between Eastern and Central time has decided to change to Eastern in order to have more daylight hours in the afternoon. A. The sensible solution of the difficulty in keeping standard instead of local time is to change the hours of the day's working time as above rather than to lose the advantages of standard time. In some cities where local time is about half an hour fast of standard time the shops and factories start at half past six instead of seven and stop for dinner at half past eleven by standard time. In reality the work begins at seven local time and the dinner is at twelve local time. The day's work closes at half past five standard, but at six local time. Thus the day is kept by the sun, but the hours are those of standard time. 3. I notice in the article referred to, in question 1: "It is stated that British Columbians now sleep during three hours of daylight in summer." Is this because their northern twilight is longer than ours, or do they get up so late? A. Twilight lengthens rapidly in the summer as one goes north. In the northern part of British Columbia there is little night in the summer, and men must sleep by daylight if they would get sufficient sleep. In the Arctic regions, men sleep by daylight all the time the sun is above the horizon without setting. At Hammerfest there are eleven weeks of continuous daylight in summer, and the people keep the twenty-four hours as we do. They open their shops at eight o'clock in the morning and close them at six of the afternoon, and sleep at the same hours as men do farther south, but it is daylight all the time.

(12984) G. M. G. asks: A suitable container is completely filled with fresh water and hermetically sealed with the same material and of the same thickness as the walls of said container. The temperature of the water is now lowered to such an extent that all the water in the container is frozen. Also kindly inform me of the expanding pressure, in pounds, of freezing water. A. Water cannot freeze unless it can expand. The force of its expansion in freezing is the same as that required to compress it from the volume it has as ice to that which it had as water. The compressibility of water is about 429 ten-millionths per atmosphere. One volume of ice yields 0.9178 volume of water at the freezing point. It will thus require about 140 to 160 tons per square inch to prevent water from freezing, and your container must have this strength. See Ganot's "Physics" for data on this point. We can send the book for $5.

(12985) P. A. C. asks: 1. Why are only three images of a point formed when two plane mirrors make an angle of ninety degrees with each other? A. When two mirrors make an angle with each other, there are as many images and the object as the angle is contained in 360 degrees. If the angle is 90 degrees, this number is four; one is the real object and the other three are apparent images. The places of the images are found by the rule that the image in a plane mirror is as far behind the mirror as the object is in front and in the perpendicular to the surface of the mirror drawn from the object. It is easy to draw the mirrors at right angles to each other, and prolong the lines to represent the apparent mirrors behind the real mirrors. Then locate the images by the rule above. 2. Will you tell me how to find, graphically, the number of images formed of a point, when the mirrors make an angle of 45 degrees? A. With an angle of 45 degrees the method is the same. There will be eight sections in the circle formed by the mirrors, which are in the space behind the mirrors; in each there will be an image, to be located by the method given above. The images will be on the vertices of an octagon. This construction is the basis for the kaleidoscope.

(12986) F. A. G. asks: 1. Will you be kind enough to tell me if the optic nerve is composed of fibers, each fiber having one of its ends connected to the retina and the other end to the cerebrum? I would like to know if each connects one or more cells of the retina with one or more cells of the brain? A. There is no difference between the transmission to the brain of a stimulus leading to sight and one producing any other sensation. The nervous system is the sum total of nerve cells, which are called "neurones" by the psychologist, and these act by conducting impulses from the point where the stimulus is applied to the part which can act upon that stimulus in the proper manner. Just how a nerve cell conducts or transmits is not definitely known, but the fact is certain. Light falls upon the ends of the neurones of the retina, and these act so that the stimulus affects the other end of the nerve cell which may be quite a distance away, and this remote end transmits the impulse along to other nerve cells, and finally it comes into the mental consciousness. It is not light which is transmitted, any more than it is sound which is transmitted over a telephone wire a thousand miles. The stimulus produces a sensation simply, but we call the sensation "seeing." 2. At the point of focus how is the motion or vibration of light transmitted to the fiber, and how is light reproduced in the mind? A. Just what the mechanics of the production of a stimulus is, we cannot say. We have always thought of it as like the wind sweeping over a field of grain. The heads bow to the breeze and rise again. The vibrations of light are transverse, and so, although infinitesimal, may be able to set into vibration the microscopic fibers of the rods and cones of the retina. The texts of Psychology discuss these matters. We can supply Thorndike's for $1.50, and James's for $1.75.

(12987) J. W. says: In the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1985, page 48, January 17th, 1914, there was published a mnemonic in French for the ratio of the circumference of a circle to its diameter to 30 places of decimals, or 30 decimal *pi*. There was a humorous challenge to anyone to construct something of the kind in English. I accept that challenge, and submit the following as the best I can do with such restrictions as are imperative, i. e., each word must be composed of a fixed number of letters. I believe that the rhythm will help the words to trip off the tongue fluently and render it easy to memorize.

Now I have a means wherewith to tackle—
3 . 1 4 1 5 9 2 6
every new poser inviting attention. Welcome
5 3 5 8 9 7
solutions may be met, although alas untrue.
9 3 2 3 8 4 6
An artful plan you get, enabling you to measure
2 6 4 3 3 8 3 2 7
quadrants.
9

In repeating these sentences it is convenient to stop at the word "tackle" and commence afresh, as at that point the rhythm changes. Of course, it cannot be expected that mnemonic sentences shall be beautiful models of language, but I must congratulate the composer of the French sentences on the success he has achieved. A question occurs to me, sir, as to whether any mathematician ever uses, or is likely to use, such an alarming mass of figures in his calculations. A. We note your lines for the ratio of circumference to diameter. Several have been sent in, and references to several which were printed in England several years ago. It is never necessary to use the figures of this number to the hundreds of places to which the calculation has been carried. We have employed fifteen figures in large computations in astronomy.

(12988) F. E. M. asks: Are two vertical lines ever parallel, and if so, under what conditions and at what point on the earth's surface? I am asking for absolute facts, and not what we consider to be parallel, such as the walls of a building. A. A vertical line is one which passes from the center of the earth to the zenith of any place. It is perpendicular to the surface of still water. Any other vertical line must, in a strict mathematical sense, make an angle with it, no matter how near it is drawn to it, since the only point in common to the two lines will be the point of their origin, the center of the earth. Two vertical lines near together are sensibly parallel. There is no instrument which could detect any convergence in two vertical lines on the equator, six feet high and one inch apart.

The Expensive Sandwich

THE widespread interest in scientific circles as well as in the ranks of social workers concerning some of the problems of nutrition among the masses is exemplified by current discussions regarding school luncies, institutional dietaries, economical menus for the household, and the cost of living. These are constantly bringing out the fact that diet customs are subject to wide inequalities in character in different parts of the world and in different strata of society; and they further make it clear that food habits are not so fixed as was once supposed, but are varied to meet economic changes and alterations incident to the shifting of population. Rubner has remarked that the scene of the changes witnessed in the nutrition of the masses lies in the cities, the country districts representing the conservative factor and adhering more closely to the dictates of tradition. It is in the cities that the most noticeable of the modern changes in dietary customs, such as the increasing consumption of meat and the introduction of ready-to-eat foods, have first taken hold on greater numbers of individuals. Furthermore, the questions of diet in large institutions almost always need to be solved with reference to the local market conditions.

Max Rubner, the eminent physiologist and hygienist of Berlin, has lately presented some interesting data on one of the many transformations in dietary custom which is peculiarly conspicuous in the cities of Germany. It is the rapidly growing tendency to introduce widely what corresponds in general to the American sandwich (*das belegte Brot*) into the daily food-intake. Anyone who observes carefully the eating habits of workingmen in this country and who has followed the enormous increase in the lunch-counter scheme of dietetics among our own population, must admit that the sandwich is something more than a trivial incident in the nutrition of those who live in populous districts. Physiologically, it involves the supplementing of bread—the common "staff of life"—with considerable fat (butter) and animal protein (meat). The sandwich represents a new step in the evolution of bread-and-butter combinations. Rubner believes that the growing use of the meat-laden sandwich is attributable, in Germany at least, to the increased employment of tea and coffee, which require some substantial adjuvant, and also to the greater consumption of sugar and alcohol. The latter lead to a lowering of the protein of the diet, which is thus equalized by the albuminous sandwich. Added to these factors is the growing tendency, especially among the unmarried classes, to eat outside of the home and to patronize the rapid-service, time-saving, sandwich-dispensing restaurants and eating-houses.

The average composition of the sandwich, if we may identify this for the purpose of argument with its German competitor, shows that it differs from plain bread in the predominant addition of fat with some increase in protein. One can attach but little value to the "average" composition of so heterogeneous a group of products as is represented by bread-and-meat mixtures of all varieties. Broadly speaking, the comparison afforded shows that 100 calories are distributed in the different food materials as follows:

	Calories		
	Protein	Fat	Carbohydrate
In bread	11	3	86
In bread and butter..	5	58	37
In meat sandwiches..	15	53	32

The great concentration of nutrients in a small volume in the sandwich at once becomes apparent here. The work of mastication is reduced and the entire make-up of the product encourages rapid eating with its possibly unfavorable consequences.

The sandwich, as here represented, exemplifies a tendency to increase rather than diminish the proportion of food of animal origin in the dietary of man; but aside from the fact that it is instituting a larger participation in the use of meat, and is thus working contrary to what many students of dietetics regard as desirable, this form of food is not as economical as is popularly believed. It is true that a palatable sandwich can be purchased for a few cents. The same proportionate expenditure in the household or in the purchase of a warm meal that deserves the name will procure surprisingly more nutriment, even in the more expensive type of restaurant. It has been calculated, for example, that twenty-five cents will buy:

	Calories	Gm. protein
In a public eating-house	3,990 containing	108
In a good restaurant...	1,990 containing	78
In form of sandwiches..	1,140 containing	30

The sandwich is frequently looked on as the "poor man's lunch" and current practice is tending to increase its use. If it is really desirable to increase the purchasing power of a small daily income so as to augment the part devoted to nutriment, the reform cannot be instituted by pointing to the supposedly inexpensive lunch counter. The boarding house and the home wisely administered on the dietetic side still remain the most economical as well as most rational centers for food reforms.—*Journal of the American Medical Association.*

What Is an Enzyme?

ALTHOUGH everyone realizes that enzymes are without question closely related to the life-processes of the cells, and are in some cases the products of their manufacture, it must still be frankly admitted that we have not yet succeeded in characterizing the so-called ferments as definite chemical substances. In truth, nothing conclusive can be stated as to their constitution, nor can they be classified consistently among any of the familiar groups of organic compounds which have a biologic import. Enzymes, in the past, have frequently been assigned to the category of proteins. The reason for this has been that the fermentative properties of certain solutions have usually been associated with the protein fractions contained therein. With respect to their behavior in precipitation, dialysis, alteration by heat, and other properties, the analogy between proteins and enzymes has appeared to be close; so that, pending the extension of knowledge with respect to the chemistry of proteins, some excuse was present for identifying the enzymes as protein in make-up. The enzymes are undoubtedly colloidal in character; and in order to isolate them in greater purity the methods commonly applied to other colloids have been used. The fact that many "purified" enzymes give protein reactions may merely mean that the albuminous material is dragged along mechanically in attempting to isolate the enzymes. Most of the methods for the preparation of them have been such as to justify this assumption. Ohta has succeeded in getting evidence of vigorous enzymatic activity in preparations that are actually free from protein. By digesting commercial emulsin—the enzyme which acts on glucosids like amygdalin—with pancreatic extracts, he has digested away the protein ordinarily found in the crude preparations on the market and has completely removed the proteolytic products by dialysis. The purified emulsin thus prepared was entirely devoid of protein, yet showed the typical hydrolytic action on amygdalin and salicin vigorously. The supposed protein attributes of enzymes must, accordingly, be abandoned.—*Journal of the American Medical Association.*

The Forests of Switzerland covered 2,091,000 acres, or 20.2 per cent of the total area of the country, in 1894, while in 1911 the forest acreage was 2,258,000, or 21.86 per cent of the whole country; an increase of 167,000 acres. Forest conservation is an even more important question in Switzerland than in most countries, because the forests serve as the only protection against avalanches and landslides, which often destroy whole villages. Only small tracts of forests are denuded at one time, and are immediately replanted. The timber is usually cut by contract with individuals and corporations at a fixed price per acre, which includes clearing the land and replanting the trees.

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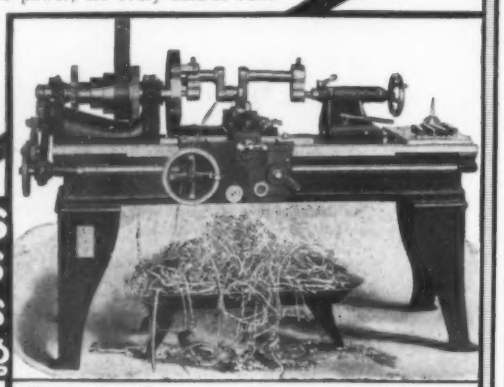

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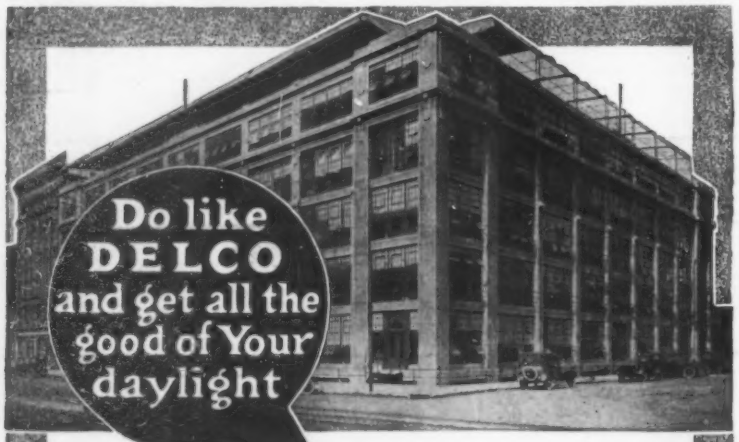

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Sweet's Catalog, 1914 edition, pages 1916-1917

NEW BOOKS, ETC.

EVOLUTION BY CO-OPERATION. A Study in Bio-Economics. By Hermann Reinheimer. New York: E. P. Dutton & Co., 1913. 12mo.; 200 pp. Price, $1.25 net.

Huxley foresaw that later generations would accept the main doctrines of Darwinism "with as little reflection, and it may be with as little justification, as so many of our contemporaries rejected them." The work under review examines those doctrines in the light of modern research and demurs to the Darwinian position that battle, famine and death directly contribute to the production of higher types. A much more important factor, the author holds, is co-operative activity, with the dietetic and digestive modifications that accompany it. His views on natural and unnatural pabulum, and on digestive transformation, are extremely interesting, and are worthy of further development. It is not necessary for us to accept his low estimate of the Darwinian plane of investigation in order to appreciate his marshaling of what we prefer to call complementary rather than opposing facts. It is regrettable that the style of the work is rather more difficult than it need have been, but its nuggets are well worth digging for.

ELECTRIC TOY MAKING FOR AMATEURS. By T. O'Connor Sloane, A.M., E.M., Ph.D. New York: The Norman W. Henley Publishing Company, 1914. 12mo.; 210 pp.; illustrated. Price, $1.

Under Prof. Sloane's cheerful instruction our boys may spend many happy hours at home in making and operating electrical apparatus and toys. The materials are inexpensive—the despised tomato can will serve for a battery—and the knowledge imparted by such a hobby never fails to prove useful in maturer years. Among the toys dealt with are the electrical dancer, the magic drum and electrical insects, while the more useful appliances and processes dispute precedence with the toys.

THE GRAPHIC ARTS AND CRAFTS YEAR BOOK. American Annual Review of the Printing and Allied Industries. Walter L. Tobey, Editor. Hamilton, Ohio: Graphic Arts Press, 1914.

The progress of the graphic arts in America is here embodied in a format of striking beauty and dignity. The illustrations are eloquent examples of the perfection to which our manufacturers and craftsmen have attained. Types, papers, inks, equipment, processes, have all harmoniously advanced together, and the result is epitomized in the impressive reproductions of the Year Book. Processes are shown in their successive stages, page after page of color enlivens the instructive articles—and the letterpress, by the way, is in true artistic balance with the illustration and binding. There is an advertising review and critique by Marquis Regan; valuable papers on engraving and typography; descriptions of the modern pressroom and bindery; and a word on office and plant efficiency. A study of the types, papers and setups exhibited in the volume would be of the greatest advantage to manufacturers, advertisers and commercial printers.

THE TRUTH ABOUT THE "TITANIC." By Colonel Archibald Gracie. New York: Mitchell Kennerley, 1913. 8vo.; 330 pp.; 16 illustrations. Price, $1.25 net.

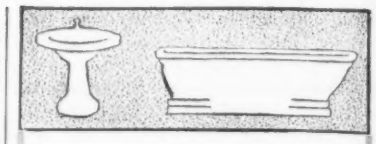
This personal narrative, once started, is as difficult to lay down as a "best seller." Naturally, it adds nothing of scientific and practical value to what was brought out in the official investigations, but as a monument to Anglo-Saxon chivalry and bravery it is almost unique. Col. Gracie went down with the ship, and only after an under-water swim of incredible duration was he able to climb upon the bottom of an overturned boat. That his head was clear and his faculties alert, even in the moments of his greatest danger and physical strain, is a fact for which we should be grateful, since it has contributed to the sharp detail of his simple, manly account. We seem actually to share the long sufferings of the night until the black, menacing bergs take on robes of light with the same sunrise that brings the "Carpathia," like the incarnation of answered prayer, into view of the open boats and their frozen freight. An excellent feature of the work is comprised in the abstracts from the American and British Courts of Inquiry, which form an admirable supplement to the personal narrative. Col. Gracie died eight months after the disaster, his death being due to, or at least greatly hastened by, the experiences of that night of terror.

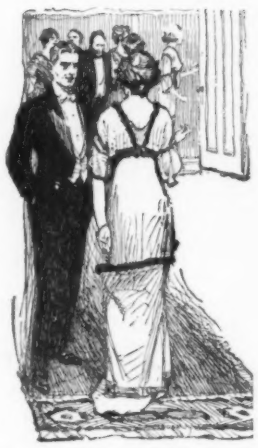
BEES AND WASPS. By Oswald H. Latter, Senior Science Master at Charter House and formerly Tutor of Keble College, Oxford. Cambridge: The University Press. New York: G. P. Putnam's Sons.

Although this book is confined to British species of Hymenoptera, it can be read with profit by American readers; for it discusses in a simple way fossores or digger wasps, diploptera (double-winged wasps) bees (anthophila) long-tongued bees (Aphidæ) and the social bees. Most interesting is the description of the structural features, namely, of the sting and the tongue.

FLOODS AND LEVEES OF THE MISSISSIPPI RIVER. By Benjamin G. Humphreys, Member of Congress from Mississippi. Washington, D. C., 1914. 8vo.; 349 pp.

The congressman from Mississippi advocates the levee system for the control of floods, his work having particular reference to proposed legislation. He urges that the disasters affecting the valley of our great central artery of trade constitute national problems of vital importance.





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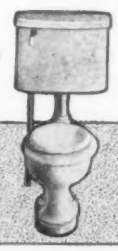

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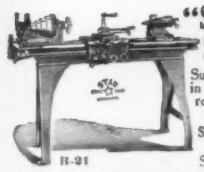

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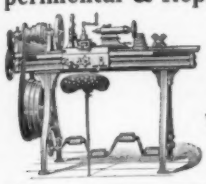

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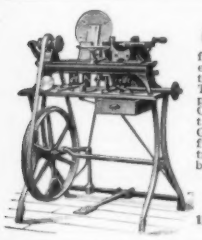

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CHEMISTRY IN AMERICA. By Edgar F. Smith, Blanchard Professor of Chemistry, University of Pennsylvania. New York: D. Appleton & Co., 1914.

Material on the development of chemistry in America is so scanty and so widely scattered that in gathering together much of it in this volume, Prof. Smith has performed a service which deserves the gratitude of every true student of American science. The chemists who play a prominent part in the book are Robert Hare, James Woodhouse, Joseph Priestley, Thomas Cooper, John MacLean, Samuel L. Mitchill, Benjamin Silliman, James C. Booth, T. Sterry Hunt, J. Lawrence Smith, Wolcott Gibbs, M. Carey Lea, J. Parsons Cooke, and J. Willard Gibbs. Prof. Smith has not made any effort critically to appraise the work of men who have made their mark in American chemistry. He has contented himself with presenting a very trustworthy and painstaking account of what they accomplished rather in the form of a chronicle. We wish that the work of J. Willard Gibbs, by far the most distinguished figure in the history of American chemistry, had been more fully dilated upon.

THE EVIL EYE, THANATOLOGY, AND OTHER ESSAYS. By Roswell Park. Boston: Richard G. Badger, 1913.

This book might well have been called "Studies in Human Stupidity." One reads the author's entertaining and instructive essays on the evil eye, thanatology, serpentism and serpent worship, the evolution of the surgeon from the barber, with a feeling that in this enlightened twentieth century we too may be committing blunders that will furnish interesting historical material for some satiric writer two centuries hence. Dr. Park seems to have done his work thoroughly and painstakingly.

LES AVEUGLES. Par Docteur André Curtil. Lyon: Henri Georg, Editeur, 1913.

French literary reviewers have hailed Dr. Curtil as a new Maeterlinck, and well they may. His book, a wonderfully sympathetic and poetic production, is a veritable prose poem in its way. Written by a scientific man whose professional life has been spent in an ophthalmologic clinic, a man who knows the blind as only they know themselves, the volume must be regarded as a great piece of literature. Particularly striking is its appealing and admirably written psychological study of the blind. Only a man touched to the very heart could have written that most pathetic portion of this book which deals with the efforts of the blind to grasp the meaning of the outer world with what senses they still have, but deprived of the most valuable of all organs.

ELECTRICITY IN LOCOMOTION. By Adam G. Whyte. Cambridge: The University Press. New York: G. P. Putnam's Sons.

This book pre-supposes nothing but the most elementary knowledge of electricity, although it does contain a certain amount of technical description. It, therefore, lends itself particularly well for popular reading.

WHO'S WHO IN SCIENCE. International. 1914. Edited by H. H. Stephenson. New York: The Macmillan Company, 1914.

"Who's Who in Science" has now reached its third year. The experience gained in publishing the two previous editions has evidently been most profitable; for not only are nine thousand scientists listed, but much valuable information on the world's universities and societies is given.

FORMULAIRE DU CANDIDAT-INGÉNIEUR. Par Maurice Percheron. Paris: H. Dunod et E. Pinat, 1914.

A vest-pocket compilation of definitions, classifications, tables and formulas, with a few blank leaves for written memoranda. Geometry, trigonometry, the calculus, algebra, physics and chemistry each have their tiny section. Space has even been found for a few miniature diagrams.

EXPORTERS' ENCYCLOPAEDIA. Tenth (1914) Edition. Containing full and authentic information relative to shipments for every country in the world. New York: Exporters' Encyclopaedia Company. 8vo.; 1136 pp. Price, including monthly corrections and the "Exporters' Review" for the calendar year, $7.50.

Those who have known the advantages of using as a desk guide previous editions of this work hardly need to be assured that in its tenth edition the same high standard of comprehensiveness and accuracy has been maintained. Among its hundred subjects are included lists of steamship lines, American consulates abroad, the countries of the world, banks and bankers in foreign trade, custom house brokers and export commission houses. There is valuable and immediately accessible information on such subjects as foreign currency, cable rates, consignments, consular regulations, financing of exports and forwarding concerns. The area, population, commerce and products of foreign countries are stated concisely. The letterpress is interspersed with blank pages, on which the corrections received from month to month may be noted

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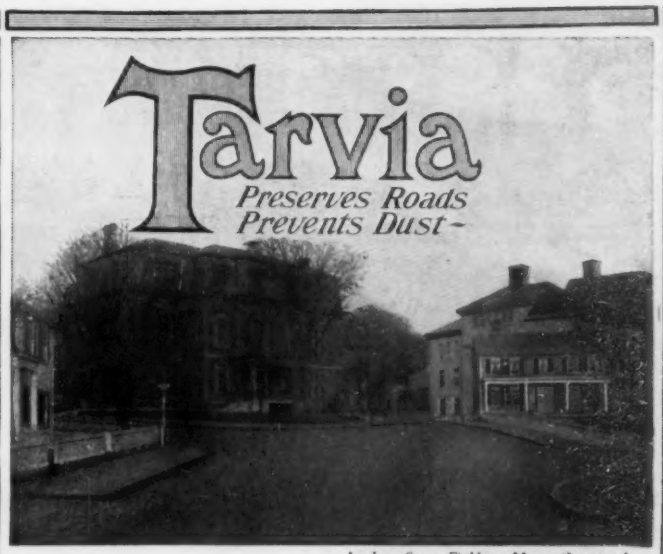

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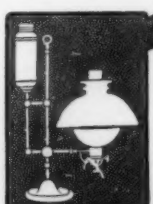

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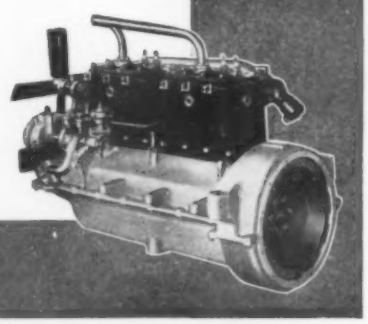

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(*Concluded from page 374.*)

justable firing mechanism for submarine mines, by which the point of explosion of the mine on the side of a ship can be determined, and which can be examined at any time for regulation and keeping in repair.

AUTOMATIC TIME CONTACT SWITCH.—H. B. MEIER, 222 Madison Ave., Port Chester, N. Y. This inventor provides a casing for a clock, said casing having a door closing the same so as to exclude dirt or other substances or conditions which might interfere with the proper operation of the clock mechanism, and said door serving, when closed, to make connection between the two parts of an electric wire, but so arranged that when the door is open, said parts are separated so that it will be impossible to complete a circuit from the battery until the door is again closed.

SANITARY TOWEL AND SOAP SERVICE.—C. H. PARVIN, 147 Fern Ave., Collingswood, N. J., and M. L. SNYDER, Wyncote, Pa. Address the former. This invention relates to automatic vending mechanism, and has particular reference to means for dispensing sanitary towels and soaps in public places. It delivers a quantity of soap, permits withdrawal of a certain amount of toweling of any suitable nature, and the operation of the mechanism for the purpose of initiating the movement thereof through the use of a coin or check serving to deliver the soap.

GATE LATCH.—D. LOUDENSLAGER, Rising City, Neb. This latch member is mounted on a gate post in such a manner that a catch of suitable device on the gate itself will, on closing, strike the latch and cause the latter to yield to permit the catch to pass to a position where the latch will automatically grip the catch and hold the gate closed.

ROAD SCRAPER AND SMOOTHER.—G. E. TUCKER, Springwater, N. Y. The purpose here is to provide a structure which may be variously adjusted for causing the smoothing or scraping members to act all together or successively, and at any desired angle to the direction of travel of the device so that the road may be operated in substantially any desirable way according to the circumstances.

FIRING APPARATUS FOR MOORED TORPEDOES.—G. E. ELIA, Rome, Italy. This invention relates to a firing apparatus for moored torpedoes or mines of the spherical or cylindrical type, and the firing mechanism relies for its actuation upon the well-known fact that a spherical or cylindrical torpedo acquires rotative motion from a vessel coming into contact therewith.

LADDER.—M. H. HOFFMAN, Box 83, Masontown, W. Va. This ladder is especially adapted for use on uneven ground, and wherein each of the stiles is provided at its lower end with an extension, capable of being moved longitudinally with respect to the stile, to lengthen the stile, and wherein mechanism is provided for operating the extensions simultaneously in opposite directions.

VENDING MACHINE.—S. C. GILBERT, Jackson, Ohio. Mr. Gilbert's invention relates to coin-controlled vending machines, and particularly machines for vending peanuts in packages. It is a design of the invention to provide an improved machine of the indicated character having a series of separate units, including carrying members and driven elements for actuating said members.

MACHINE FOR COVERING ELECTRIC CONDUCTORS.—E. H. COOK, care of Miss A. M. Harrison, 99 Keap St., Brooklyn, N. Y. The present invention relates to a machine for covering a wire or conductor with insulating material, and has more particularly reference to an improved structure for applying asbestos or the like to wire or conductor.

STRIP GUIDE FOR SEWING MACHINES.—F. L. CORSON, 87 Winter St., Rochester, N. H. The device, which is preferably attached to a sewing machine, holds the ribbed portion of the canvas between the sides of the canvas in position, while it spreads the sides of the canvas, and holds them against the inner sole, while it is sewed thereto.

ATTACHMENT FOR STEREOPTICONS.—H. A. GOTTLIEB, 129 E. 59th St., New York, N. Y. The invention provides a magazine for holding lantern slides, with co-operating parts for successively permitting the slides to be positioned in front of the condensers, such operation, together with the consequent operation of taking care of the exposed slides, being under the control of the operator.

Prime Movers and Their Accessories.

ROTARY ENGINE.—E. F. GIROD, P. O. Box 452, Monroe, La. An object here is to provide a novel form of device which will rotate in either direction by merely turning the valves of the intake and exhaust pipes. The invention provides a rotary engine having a novel form of valve operating mechanism, and a rotary engine having a pair of pistons acted on alternately at points 180 degrees apart.

Railways and Their Accessories.

STREET INDICATOR FOR CARS.—F. H. WEBSTER, Marvel, Ark. This invention has reference to street indicators, and more particularly to street indicators carried upon cars, for the purpose of disclosing, to persons occupying the cars, the names of the streets, in successive order, as the cars travel along.

Pertaining to Vehicles.

AUTOMOBILE STARTER.—H. H. MOSELEY, 118 Atlantic St., Atlantic, Mass. The primary object of the invention is to provide an efficient and positively operable device capable of operation by the chauffeur from the steering seat to impart initial cranking motion to the crank shaft of the motor for starting the latter, thus obviating the necessity of the chauffeur alighting from the car.

RADIATOR.—R. H. HATFIELD, 1481 Union St., Brooklyn, N. Y. This invention relates preferably to the type designed to remove the heat from the cooling water of the engine of an automobile or other vehicle, and the primary object thereof is to produce a radiator which will be of simple and practical construction, and at the same time operate with the highest possible efficiency.

ROTARY MEASURING DEVICE.—E. C. SPEDDEN, Grangeville, Idaho. This instrument is for use in connection with vehicles for measuring the distance a vehicle travels on an imaginary horizontal line irrespective of the contour of the road on which the vehicle travels. While useful in this particular application it may be employed to make linear measurements generally.

LIMBER PIN FOR MINE SKIPS.—C. H. SAWYER and J. BOWDITCH, Newcastle, New South Wales, Australia. This improvement relates to devices for coupling a mine skip or like vehicle to animal draft gear, and has been designed to provide for that purpose an improved limber pin of simple and strong construction adapted to effect such engagement with the draw bar hook of said vehicle that the same may not become detached and withdrawn during progress of the vehicle, but further may be manually disengaged with facility.

AUTOMOBILE WRENCH.—P. S. MERRILL, 185 Main St., Waterville, Maine. The object of invention No. 1,092,071, is to provide a simple, inexpensive and strong wrench combining the features of a monkey, pipe, and ratchet wrench designed for use in reaching any nut or bolt at any angle. This is obtained by providing a shank having an extension in the shape of a sector, a jaw pivotally mounted on the shank and associated with the sector, a second jaw slidably and adjustably mounted on the shank and co-operating with the first jaw and a handle adjustably mounted in the sector whereby the wrench is manipulated.

RESILIENT WHEEL.—P. F. MARCANTE, 429 Cedar St., Allentown, Pa. An object here is to provide a spring wheel structure in which the various springs are retained under a predetermined tension, and are all caused to act in unison when there is a sudden jar or load placed on the wheel whereby lighter springs may be used, as all the strain of a sudden weight or jar does not come under a single spring.

SNOW PLOW.—W. L. STADIG, St. Francis, Maine. This invention provides co-acting means for taking up the snow and causing it to be raised and deflected to the side of the road. It removes snow from highways, logging roads, and the like. It provides means associated with the rotary elements, and adapted to gather the snow to the latter, the said means being arranged for adjustment to the road level, or to leave a "comb" in the road center.

ROAD WAGON.—A. MACDONALD, Bundarra road, Inverell, New South Wales, Australia. The present invention has been devised to provide a combination four-wheeled farmer's wagon and tip-dray so arranged that the rear portion of the wagon may be tipped and is detachable for separate use as an ordinary two-wheeled tip-dray.

SPRING WHEEL.—R. FOURCHY, 211 Post Office, Kansas City, Mo. This invention refers to spring wheels for vehicles and has reference more particularly to the resilient connection between the rim and the hub, said connection comprising a plurality of independent resilient units located between the spokes and intermediate the rim and the hub.

LAMP MECHANISM FOR AUTOMOBILES.—R. C. BROWNE, Lock Box 257, Cona, Ill. This invention provides a lamp mechanism controllable automatically by the steering wheels and parts connected immediately therewith so that when the steering wheel is turned the lamps of the vehicle are turned to correspond with the angular direction in which the vehicle is turning.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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